Pacific Discovery

PUBLISHED BI-MONTHLY BY THE CALIFORNIA ACADEMY OF SCIENCES

IN THIS ISSUE: *William Beebe*
J. Wyatt Durham . *Paul J. Fair* . *Robert Cunningham Miller*
Woodbridge Williams . *Earle G. Linsley*

VOLUME II . NUMBER 2
March-April 1949
FIFTY CENTS

A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

THE CALIFORNIA ACADEMY OF SCIENCES

SAN FRANCISCO

BOARD OF TRUSTEES

J. W. Mailliard, Jr. . . . . *President* Charles Page . . . . . *Vice-President*
Bruce Cornwall • Mrs. Joseph C. Fennelly • Edward E. Hills • Daniel E. Koshland
Norman B. Livermore • T. S. Petersen • Mrs. Henry Potter Russell
Brayton Wilbur
The President of the Academy, Ex Officio • The Treasurer of the Academy, Ex Officio

OFFICERS OF THE ACADEMY

M. E. Lombardi . . . . . *President*
E. B. Babcock . . . *First Vice-President*
George S. Myers . *Second Vice-President*
E. O. Essig . . *Corresponding Secretary*
J. Wyatt Durham . *Recording Secretary*
Francis P. Farquhar . . . . *Treasurer*
Charles H. Danforth . . . *Librarian*
Robert C. Miller . . . . . *Director*
The officers named above constitute the COUNCIL of the Academy

SCIENTIFIC STAFF

Robert C. Miller, Ph.D., *Director*

Toshio Asaeda . . . *Assistant Preparator of Exhibits*
Robert P. Dempster, M.S. *Aquatic Biologist*
Alice Eastwood . . . *Emeritus Curator of Botany*
W. I. Follett . . *Curator of Ichthyology*
G. Dallas Hanna, Ph.D. . . *Curator of Paleontology*
Velma Harris . . *Assistant Preparator of Exhibits*
Earl S. Herald, Ph.D. . . . *Curator of Aquatic Biology*
Leo G. Hertlein, Ph.D. . . . . *Assistant Curator of Paleontology*
John Thomas Howell, M.A. . . *Curator of Botany*
Edward L. Kessel, Ph.D. . . . *Research Assistant in Entomology*
Hugh B. Leech, M.S. . *Assistant Curator of Entomology*
Elizabeth McClintock, M.A. . . *Assistant Curator of Botany*
Robert T. Orr, Ph.D. . . . *Curator of Ornithology and Mammalogy*
Mary L. Perry, B.A. . .*Research Assistant in Mammalogy*
William B. Pitts . . *Honorary Curator of Gem Minerals*
Edward S. Ross, Ph.D. . . . *Curator of Entomology*
Veronica J. Sexton . *Executive Librarian*
Joseph R. Slevin . *Curator of Herpetology*
W. Barclay Stephens, M.D. . *Honorary Curator of Horology*
Cecil Tose . . . *Preparator of Exhibits*
Edwin C. Van Dyke, M.D. . . *Emeritus Curator of Entomology*
M. Vonsen . . . *Honorary Curator of Mineralogy*

RESEARCH ASSOCIATES

Mr. C. C. Church • Professor E. O. Essig • Professor G. F. Ferris
Dr. J. Linsley Gressitt • The Reverend Edward S. Guedet • Dr. Thomas H. Kearney
Dr. Earle G. Linsley • Dr. E. Gorton Linsley • Mr. Anatole S. Loukashkin
Mr. Borys Malkin • Mr. Lewis S. Rose • Mr. Lawrence W. Saylor
Mr. Allyn G. Smith • Mr. A. M. Strong • Dr. R. L. Usinger

Founded in 1853

VOLUME II • NUMBER 2 **Pacific Discovery** MARCH-APRIL 1949

In This Issue

Pre-Discovery

PD will take you "Out of This World," next issue, at least out of the familiar world of modern inventions. Where we'll go, our plain oldfashioned moldboard plow, for example, with horse attached, would be as novel as a supersonic plane to the Montgolfiers. High in the Peruvian Andes, descendants of the Inca-ruled people Pizarro conquered still live in the 16th century. Their footplow—mere stick with crosspiece for the human foot to push against—remains standard, even though it still leaves the clods to be turned over by the wife and kids. And "the one work animal they succeeded in domesticating – the haughty llama—never permitted . . . himself to be harnessed for draft purposes." Yet, with such tools and manpower only, these *sierra* Indians evolved centuries ago "a truly scientific agriculture." Stanford's Professor C. Langdon White tells their story after spending many months with them.

Apparently Robert T. Orr likes to do his field work in some region where the fewest possible persons have been between the first explorers and himself. So last summer he and his wife camped "On the Lolo Trail" over which Lewis and Clark crossed the Bitterroots in 1805 and Chief Joseph and his warriors retreated in 1877. Happily for wilderness lovers like the Orrs, not too many other people have gone that way. Lolo Pass is "gateway to a vast primitive area rich in plant and animal life as well as scenic beauty," probably "less explored than any other comparable mountainous region in the United States," except the nearby Salmon River Mountains.

Discovering PD's Authors

"The Private Lives of Jungle Falcons" previews **William Beebe's** first book in seven years, *High Jungle* (Duell, Sloan & Pearce), out in May. Dr. Beebe, you know, is a zoölogist who studies his animals where they live, be it half a mile below the waves, or half a mile up in a Venezuelan mountainside jungle, his field station in 1945, 1946, and 1948.

In Sumatra as petroleum geologist for Standard of California, **J. Wyatt Durham** spent vacation time prowling around ruins of the ancient "Hindu Temples of Padang Lawas." There on sparsely inhabited grassy plains, his camera got what's left of a once flourishing Oriental kingdom and a religious sect whose priests frienzied themselves on the warm blood of human sacrifices. Dr. Durham was glad he came a few centuries late to church.

People who spend a good deal of their lives pursuing birds and animals with a camera seem to develop certain traits in common: keenness, patience, humility, and a friendly respect for their subjects. To gain the front rank in their company one must be thoroughgoing naturalist, artist, and technician. Such is **Paul J. Fair** of Berkeley, California, whose three studies of "Our American Deer" provide this issue's cover and Photo Center.

Robert Cunningham Miller's "Flight Into Tomorrow" took him to the Seventh Pacific Science Congress as delegate from the California Academy of Sciences, the National Research Council, and the Pacific Division of the A.A.A.S., of which Dr. Miller is secretary.

Woodbridge Williams ("Paradox in Stone," *PD*, Nov.-Dec. 1948) is a marine biologist and photographer with a penchant for puzzles, to judge by his titles. This time it's "The Enigma of Mission Bay." Woody now lives at Inverness, so we expect any day a MS. entitled "The Teaser of Tomales Bay."

Our contributor in Astronomy, Dr. **Earle G. Linsley,** has campaigned long to popularize those "Brickbats From Space," the meteorites. He feels that many more of these chunks of iron and stone which pelt the earth should be found in our backyards, in corner lots, or most anywhere. Scientists who study extra-terrestrial matter need them to work on. Turn in your scrap iron. D.G.K.

Pacific Discovery is published bi-monthly at the Gillick Press by the California Academy of Sciences. Publication office: 2057 Center Street, Berkeley 4, California. Editorial and Advertising offices: Golden Gate Park, San Francisco 18, California. Subscriptions: $3 per year. Single copies: 50c. Members of the Academy subscribe through their dues. Entered as second-class matter February 17, 1948 at the post office at Berkeley 4, California, under the act of August 24, 1912.

On Breaking New Ground

Breaking ground is nothing new to the California Academy of Sciences. This time it's a Planetarium!

IF THE NEXT FEW ISSUES of *Pacific Discovery* have more than the usual number of typographic errors or editorial slips, please make allowance for the rather strenuous conditions under which the staff is working these days.

Progress is in the air. It can be measured just now in decibels of sound produced by shovel, bulldozer, air hammer, and other heavy construction equipment—all operating full blast directly under the editor's windows in Simson African Hall.

If you have your copy of *PD* for May-June 1948, look again at the air view (page 2) of the Academy buildings in Golden Gate Park. The tree-covered space referred to in the caption as the site of future buildings is now a gaping hole. The Academy has broken new ground.

"Breaking New Ground" has become a stereotype to describe beginnings. In thus titling his final book (reviewed in this issue), the late Gifford Pinchot signified the founding of a movement, Conservation, and the beginnings of modern scientific forestry practice in the United States on a national scale.

Now, breaking ground in either literal or symbolic sense is nothing new to the California Academy of Sciences. Its founders pioneered institutionalized science in the West when they met to form the Academy in 1853. The growing Academy broke ground on Market Street in San Francisco in the 1890's to build the first major science museum west of the Mississippi. Rapid physical growth again brought new power to serve world science and public education when in 1915 the Academy reopened, after its total destruction by the Great Fire of 1906, with the completed North American Hall in Golden Gate Park, when in 1923 it dedicated the Steinhart Aquarium, and when in 1936 it opened the Simson African Hall.

If physical growth is seen desirable in itself, mere bigness may be the product. But if an institution such as our Academy is infused with the ideal of fulfilling its unique mission in the community, planned increase in scientific and public facilities is not only desirable but necessary. An institution, like a person, must mature, must reach toward full stature.

Fortune, even opportunism of a sort, have con-

tributed to our development. But for the fire of 1906, the Academy might still be bursting its outgrown Victorian walls on Market Street. San Francisco's civic wisdom, abetted by the generosity of a few citizens like Ignatz Steinhart and Leslie Simson, have provided the ground and buildings of today's Academy. The new building, in turn, will owe its realization to a like combination of civic and individual greatness as well as to the Academy's readiness to take on still greater responsibilities and to meet the challenge of new directions in scientific thought and the pressing need for popular understanding of the implications of change and progress.

For this year's ground breaking signals more than enlarged plant; it means also that the Academy recognizes new trends and new urgencies. Progress in the natural sciences is no longer measured largely by the volume of description and cataloguing of facts in nature; nor is education completely served by glass cases of specimens in arbitrary arrangement. Interpretation, synthesis, application are the order of our day. Man needs now as never before to understand his place in the biological and physical world, to know his bounds and how to keep them, lest he put his big monkey wrench into vital parts of this delicate mechanism that supports him and all other life—the biosphere, it has been called—far enough at last to bring the whole works down in total disruption. It will be the purpose of one part of the Academy's new structure, namely the Lovell White Hall of Man and Nature, to teach us about ourselves and how we fit in the natural scheme, and to demonstrate the ever-growing need for conservation and wiser use of natural resources.

With the Morrison Auditorium, seating nearly 500 people in comfort, the Academy will have the capacity to become northern California's center for popular learning and enjoyment of nature and the sciences by means of lectures, moving pictures, and demonstrations.

The addition to Simson African Hall will substantially increase our habitat groups portraying animal life on the continent that holds the last great living space which man has left—and he is fast usurping even this—to any large numbers of his noblest and most interesting contemporaries of the Age of Mammals. This wing will also provide space for exhibits of birds, insects, plants, geology, and geography of Africa.

One of the chief purposes and greatest privileges of an academy of sciences is the encouragement and instruction of young persons eager to know and understand the natural world. With greatly enlarged facilities, we can give more, through our flourishing Junior Science Groups, to even greater numbers of boys and girls; with enlarged space for research departments, we can more adequately help older students who have chosen careers in the natural sciences. (Fittingly, the volunteered nickels and dimes of school children contributed no insignificant amount to the total building fund – to the Planetarium Fund in particular.)

Apex of the splendid architectural pile destined to fill our newly broken ground will be the imposing dome of one of the most perfectly devised, inspirational, and educational instruments man has ever conceived to help him understand the beauty and mystery of his Universe—the planetarium. Ours will be called the Alexander F. Morrison Planetarium because a bequest from the Morrison Estate provided the heart of a concretion of funds which made its erection possible.

It may fairly be said the Academy was in a certain sense opportunistic in assuming the task—the trust—so enabled, of building and operating this instrument, which will be one of the two in all of western North America. Yet so long as an advancing society demands such noble luxuries as planetariums, and so long as a center of culture like San Francisco has men and women with the vision and determination to provide one of these instruments through their own means for the pleasure and benefit of all—an existing center of science and education is the logical place for it. Quite fitting it is that an institution dedicated to the purposes of this Academy of Sciences has accepted the donors' designation as the Planetarium's proper seat in this great metropolitan area. If this was opportunism, it entailed responsibility and, for us, the breaking of much new ground.

D.G.K.

WILLIAM BEEBE

The Private Lives of

THE RAINS HAD NOT YET STARTED on the twentieth of February, and from a half mile up in the central Venezuelan Andes we looked down from our medieval castle of a laboratory through dancing heat haze, across Limón Valley to Lake Valencia. We were settled down to a half year of research on this, the forty-seventh expedition of our department.

A great many years ago one of the three giant candelo trees now facing Rancho Grande withstood a mighty tempest, but one of the largest branches about fifty feet above the jungle floor was wrenched away and fell to earth. This left a gaping wound, which sap and wood set to work to heal. Out-flaring, wavering lips of bark began to curl over the hole. Then rot or water or some agent interfered and the still exposed heart wood softened and flaked away. This in no way interfered with continued growth of the enormous bole, but left a semi-hollow, shallow but well cupped, which in the year 1948 was to prove to be *dulce domum* to a pair of bat falcons. We in Rancho Grande discovered the hollow, and through an open laboratory window our mighty binoculars were leveled at the nest. Although we were one hundred yards away, no slightest doing, no casual or intentional activity was hidden from our prying eyes, no intimacy was foreign to our gossip sheet.

The setting of the arboreal eyrie was very lovely. Three sides of the two-by-one-foot opening were exposed, lichen-covered. Down the fourth side a mass of air-plants cascaded from an enormous burst of alien foliage, twenty feet above. Within a few feet of the hawks' home were a score of kinds of lush growths, and as the nestlings grew, so these plants, at the first hint of rains, put forth new shoots, leaves and blossoms; orchids flowered, as did bromeliads, jungle arums and tropical mistletoe.

Four long, dangling air-roots hung at one side, their beginnings so high up that they pendulumed slowly in the slightest breeze, and when wind-blown neblina swirled through the pass and around the candelos, the vegetable ratlines flapped and thrashed like wrecked rigging. After each gale, one or more would be caught by some distant twig or branch, and the loop would swing to and fro in front of the nest, until the next wind usually loosened it. We learned from this how the mighty lianas of the jungle loop themselves from tree to tree; the blowing and entangling of a thread, progressing by aeolian-thrown lassos, establishes the permanent aerial loops and curves and bridges, and the juvenile plant cords grow into massive three-inch wooden cables.

Somehow this account of the bat falcons seems to be getting itself written in reverse, but at least it is reasonable at this point to present some hint of the appearance of these birds, especially in these days, when there seems a united front of labor unions, artists, paper and water-color makers, and printers, against the possibility of color illustrations in the works of impecunious naturalists.

Bat falcons are unusual among hawks in the complexity of their patterns, and as for brilliance many tanagers and hummingbirds are duller. From above, both sexes appear black with a slaty-blue sheen and narrow, gray tail bars. What the chicks see as they look up at their mother is a particolored plumage, black face, chin and throat apricot buff, most of the body black set off with elegant cross bars of white fringe, while the lower body and leg plumage is rich cinnamon rufous. When she spreads wide her wings and tail, whole constellations of white spots spring into view.

We have not the slightest idea of the use or reason for this delightful and complex pattern. With such perfection of vision as these birds possess there is little need for any obvious recognition signals. With lightning speed at their command, to these falcons such words as disruptive, protective or warning coloration are meaningless. Also when the little hawks essay their first flight from the nest, they are all but indistinguishable from their parents.

f Jungle Falcons

AT SEVEN-THIRTY on the morning of February twentieth a bat falcon alighted on the topmost stub of the giant candelo facing our laboratory at Rancho Grande, and raised his voice in a loud, chattering *ke-ke-ke-ke.* Of his parents and birthplace I knew nothing, nor *their* parents, nor on back through the ages to the dawn days when his feathers were still scales and he scampered about on what are now wings. I did not even know from what direction he had arrived this morning, nor what tree had been his last perch. But from this instant, throughout the succeeding five months, we were to live in intimate though extremely one-sided relationship. My part was to be only a dull, static observer, eternally ogling, vitally interested. He and his family were to furnish emotion, drama, tragedy, comedy, excitement, surprise.

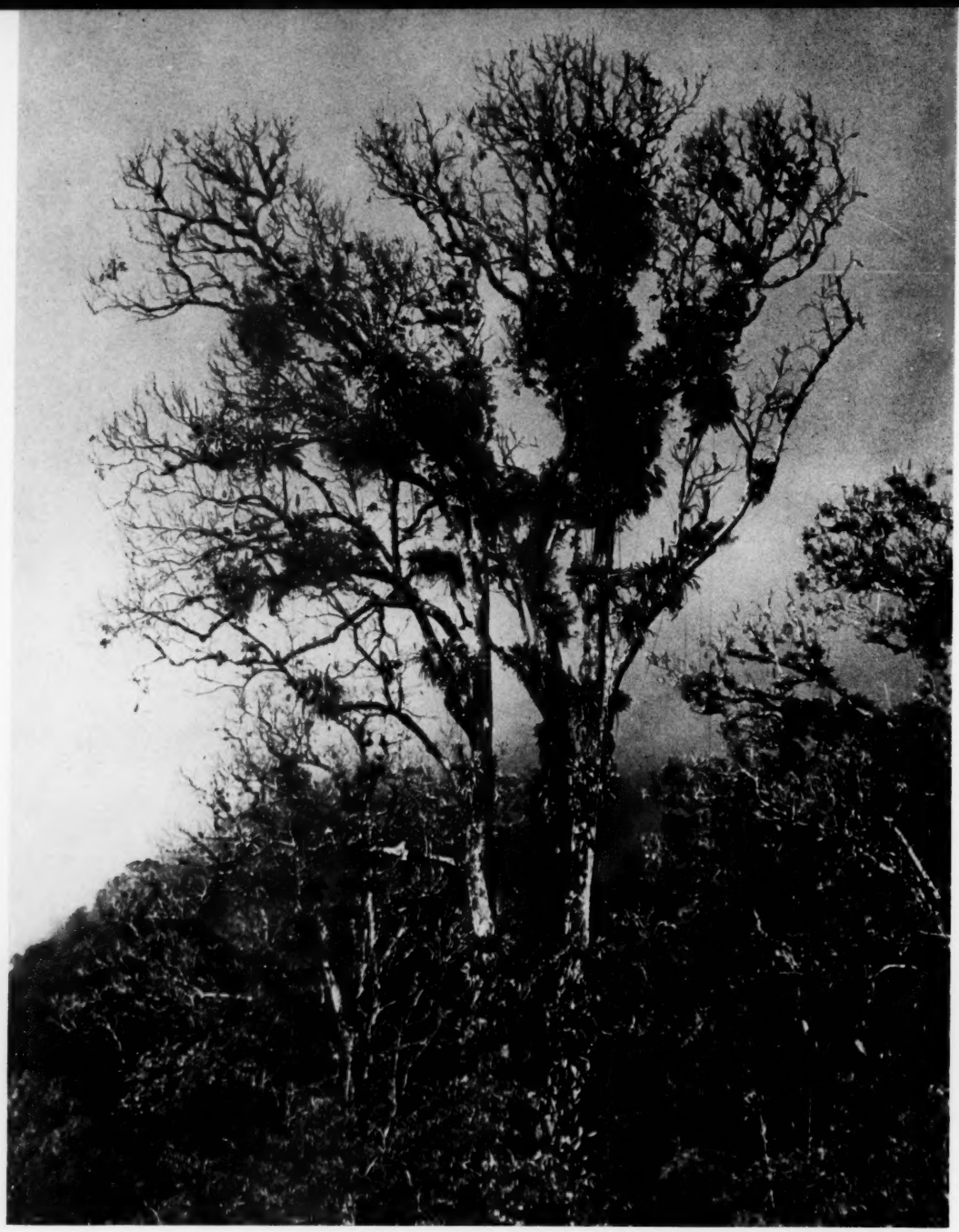
Bat falcon. (Sketch by Louise Moore)

At seven-thirty he left his perch. I watched his rapidly beating wings in a flight which appeared only moderately strong. When far out over Limón Valley, without the slightest warning, he dropped straight down, in a plunge so swift that my glasses could not follow. He did not drop the way a bird falls; this was a power dive, to pull out of which would seem to tear the very plumage from his body. He vanished among the jungle tree-tops, and I, rather breathless, turned back to my interrupted work, something which had to do with the syrinx of a swift.

Ke-ke-ke brought me with a rush again to the great binoculars in time to see the falcon alight, bearing a bundle of feathers, while he called and scanned the whole horizon. I saw every pattern and color of the prey—turquoise blue above and below, set off by a black mask, with the center of the breast and lower body dazzlingly white, as the coat of a beau brummel is cut to display a satin waistcoat beneath—a swallow-tanager, one of the loveliest of small tropical birds.

The fierce little hawk tore away at the plumage, sending it flying in the wind in a gust of feathers. As I watched, another larger bird entered the field, banked sharply, braked to momentary immobility, reached out slender, yellow toes and talons, seized the tanager and was away to a high perch on the neighboring candelo. The opening overture was merging into the first act in high gear; all sorts of contradictory similes flashed through my mind. Then I became pure ornithologist and knew the second bird for the female of the species—she seemed a good quarter larger. The usual individual hunting of the bat falcon pairs had changed to a new relationship, a division of labor of the most important raptorial activity.

She finished plucking, showing greater strength than her mate, and wing and tail feathers flew into the air over her shoulders, like a flurry of King Hal's drumsticks. She worked swiftly but systematically and soon held a clean-picked, little red-muscled torso, which she proceeded daintily



Giant candelo tree with falcon's nesting hole among the orchids and bromeliads. (Photograph by Jocelyn Crane)

to tear apart and swallow. Meantime the male picked tentatively at some shreds left on his talons. Half an hour later when his companion had finished her meal, he flew straight to her and mated.

During the next few days both birds came and went in early morning, and on the twenty-seventh of the month I saw prey being carried. This time the victim was one of my own fellow countrymen, a male redstart, headed on his northward migration. The hawk plucked and ate his catch and this time the female did not appear. From March first to the fourteenth we were away from the laboratory, but on the latter date the male appeared promptly on his perch, his plumage drenched after the night's heavy rain. After diligent preening and ten minutes' sun-bath he left, and soon returned with an unfortunate male blackpoll warbler, which I knew was well coated with fat in

preparation for his fifteen hundred-mile flight across the Caribbean. Later he caught and plucked a honey-creeper and vanished somewhere into the lower foliage of his tree.

A few days after this, by accident, we discovered the nest, which, as I have already told, was in full view, in the perching tree of the male. By retrogressive calculation and circumstantial evidence we knew that three eggs must have been laid in the week of March fifteenth. From the fifth to the tenth of April we were exploring the llanos far to the south, but on the eleventh the shallow hollow was alive with three, fluffy white hawklets, certainly one week old.

UP TO THIS TIME we had recorded the capture of tanagers, euphonias, seedeaters and warblers, but from now on intensive watching revealed a constant succession of intimate and exciting details. My journal for the twenty-fifth of March says that the male was on watch at six in the morning, left and returned with prey, which the female took. When I reached the glasses she was tearing at a large, brown bat—justifying the common name of the species. After several mouthfuls the hawk flew to a branch laden with air-plants, carried the bat several feet along the limb and pushed it down among the leaves of a bromeliad. She left for her nest and at three in the afternoon returned, salvaged and ate the bat. This is the first time I ever knew a hawk to cache prey. During the time of incubation the male not only caught, killed and plucked, but carried the neatly prepared food to the female on the nest.

The following day I watched one of these birds being taken to the nest. The falcon leaped a foot into the air above his perch, and let himself fall straight down between the two great trees. On the way he passed through a flock of shrieking parakeets. They had no time to be alarmed. They might have been stationary in midair in comparison with his speed. They were certainly too large and too well prepared for defense for him ever to attack them, and to an imaginative onlooker the dive among them was one of sheer devilment, scaring the daylights out of the small parrots.

On the twenty-ninth of March the hawk caught a white-winged swallow, which is of interest because it never occurs at this half mile elevation above the sea except as a migrant through the pass, going from lowland to lowland. A still more astonishing capture was a full grown white-collared giant swift, almost as large as the male hawk himself, and on a horizontal stretch infinitely the swifter bird. Every capture which I observed was made from a high level in a power dive on the bird far beneath. I once saw four of these same swifts attacking and putting to flight the male falcon, whereas if they had been far below him they themselves would have had to flee.

After the young had hatched, the prey was prepared with more care than ever, and sometimes not a single pin-feather could be seen. The method of transfer reminded me of the way mail-bags are snatched by a fast moving train from an ingenious gadget on railway stations. The male held the carcass in one foot, and rested on his heel, thus projecting the foot and prey beyond his body and the other foot. The female zoomed up from one side, and seeming hardly to slacken her speed, reached out both feet, engaged and snatched the bird's body without the slightest jar or jerk to the foot of the male. It was the perfection of aërial transmission.

The first time I saw the chicks fed, all three shared equally, gaping and uttering nursery-sized *ke-ke-kes*. The mother tore off tiny bits, and turning her beak sideways let the little fellows pick them off. If a piece proved too large she took it back and swallowed it herself. Two things came at once to our attention: one most practically sanitary, the other inexplicable. After every meal, with crops bulging, the chicks, one after the other, clambered with great effort to the nest rim, backing up as if to make it harder. When they were near the edge they sent forth a shower of white lime, thereby instinctively keeping the nest clean and undefiled. This appearance, development, and subsequent dying out or shifting of instinct after instinct was the most vitally interesting phase of the lives of these falcons. A second thing which the chicks began at this early stage was the curious nodding and bobbing of the head and neck, so characteristic of these and some other hawks. In a few more days they outbobbed their parents. There was never any slow turning of the head from side to side, or up and down, only quick shifts of intensive looking, each shift accompanied by one or two vertical bobs. Such constant muscular effort must be of real optical importance, but to blind human interpretation it is as meaningless as the foot waving of the jungle runner lizards.

Three days later two of the nestlings were decidedly larger and stronger; the third had to fight

for even a small ration. There was no feeding in succession by the mother falcon; she tore off a piece of flesh, held it out, and whatever beak was nearest and opened widest got it. Beyond this, mother instinct ceased, there was no discrimination, no notice taken or extra care given to the weakling. Two more days and Dopey ousted calm ornithological recording, and tore our heartstrings, as we watched him trying so hard to break into the food queue, wanting so much to live, and being elbowed or winged aside. Another twenty-four hours and his little undeveloped head and body were actually knocked over and trampled by his ravenous brethren. We never saw him again. Whether he was stamped into the chips at the bottom of the nest, or was thrown out, or (horrid and most unlikely thought) whether he joined the succession of other birds, we shall never know.

Not long afterward we began to notice a difference in size between the two remaining hawklets and we wondered whether we were again to witness the climax of a relentless struggle for existence. But this was a happier phenomenon, the smaller of the two nestlings proving to be a male, in comparison with his larger sister.

As is usual in our field work we gave tentative shorthand names for use in journal notes, and here, ready to order were our nicknames. Instead of writing adult male, adult female, young male, young female, we compromised on male, female, Bob and Nod. This is not sickly, maudlin, anthropomorphic baby-talk—it is a time-saving device, and until our notes resolved into technical publication "Bob" was as distinctive as "*Falco albigularis albigularis* Daudin 1800, juvenile male." Indeed, there is a subtle advantage in the shorter appelation, for another century and a half hence, Robert's descendants will be certain to be bobbing like mad, whereas some diligent ornithological bibliophile may have dusted off a hidden tome and found a name with priority over that of Daudin's.

THE YOUNG BIRDS THROVE and daily became less downy and more pin-feathered, as what nestlings would not on a diet of hummingbirds, swifts, swallows and tanagers, with bats as a frequent change of menu? Once the male alighted with difficulty on his lofty perch, owing to the great flapping wings of a morpho butterfly, the four pinions of the insect presenting more actual surface than the two of the hawk. He cut them loose one by one, each as it fell reflecting to our eyes an instant's heliograph of blazing, iridescent blue. It seemed a most uneconomic amount of effort to capture, transport and dismember this butterfly for the mere beakful of body substance.

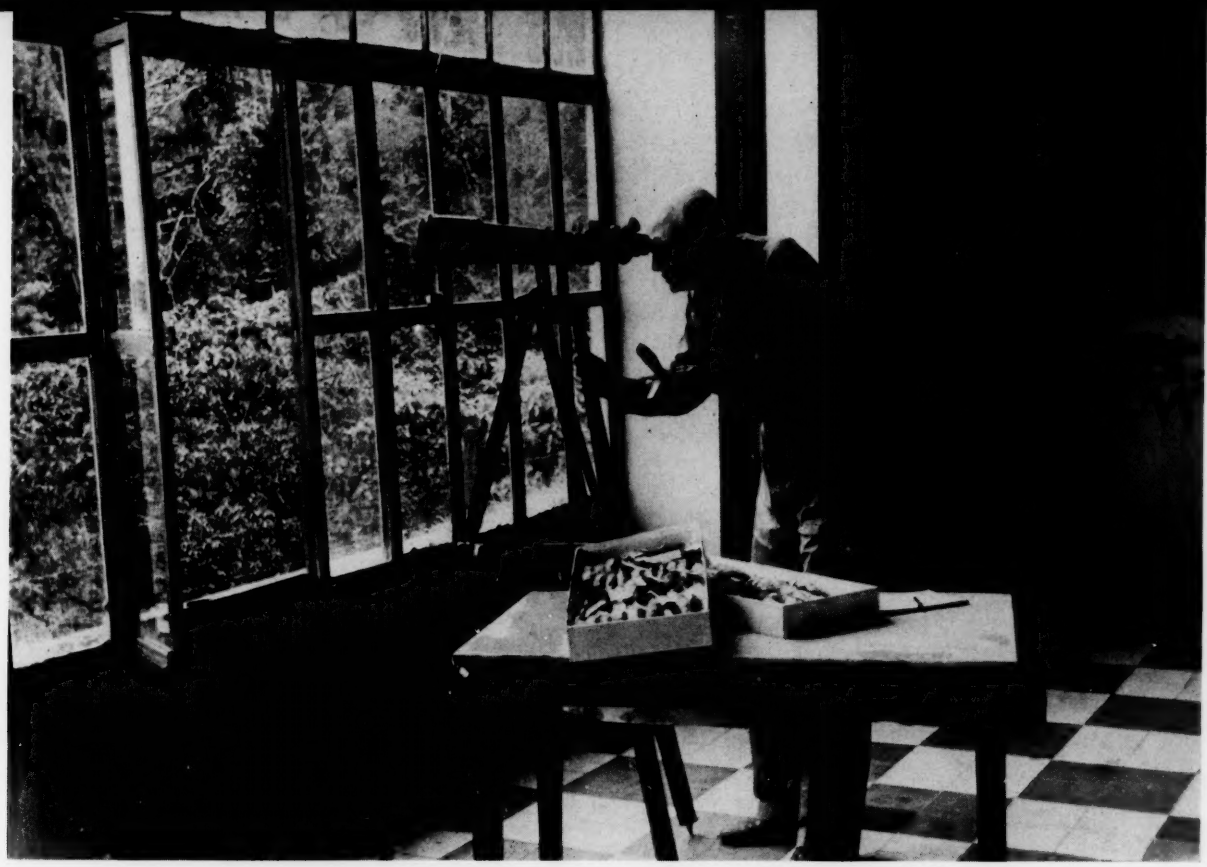
One day I watched through the binoculars a twelve-inch, jade-green lizard climbing up a tree trunk, now and then catching hapless little flies. He came to an out-curving ledge of bark. Nothing in ancestral instincts held any warning about peering over bits of bark. So he did. In the same instant, however, life ended, for the mother falcon was brooding, and she had only to dart forward her beak to obtain this bit of manna, so unexpectedly provided by some avian Providence, or could it have been Horus?

The first pinch of the beak killed the lizard, but all unknowingly he got a bit of his own back, for as usual, the long tail soon dropped off and performed its dance of death, much to the embarrassment of parent and young. When an inch or two of the base had gone down Bob's throat, the remainder of the tail twisted and curled and lashed about, postponing total engulfment for many minutes, and requiring all the efforts of the two birds, while Nod watched the performance with a most puzzled expression.

Life in the nest was an eternal preening, pulling at loosened down, and nibbling at sprouting feather sheaths; gazing at the flies which danced in midair, watching the swaying lianas and wondering at the blossoming orchids. No roar of howling monkeys or chattering of caciques ever attracted or held any interest, but at the first distant call of the parents, the nestlings sent forth a duet of pleading *ke-ke-ke-ke* for another intermittent meal, and then strove with all their small selves for a full share when it arrived.

The sequence in change of preparation of prey was interesting. When the female was incubating she often took the food half-plucked, finishing it herself. Then, for the very young birds, all feathers were removed, together with the head and the stubby, featherless wings. Finally, when the fledglings were stronger, the prey was plucked less and less in instinctive preparation for coming activities when the young birds would have to fend for themselves.

The coating of down gave way to stray tufts, and little by little, the incoming plumage revealed the buff and rufous, black and white of the adult falcons. The small size of the nest hollow brought about certain mutual adaptations. When one bird



The author, with binoculars trained on the bat falcons' nest, showing the method of studying birds from the Rancho Grande laboratory. (Photograph by Jocelyn Crane)

wished to exercise its wings, the other flattened out on the bottom or scrambled up one side out of reach of the flapping pinions. Later the birds reversed, and Nod then had sufficient room for her Swedish jerks.

As the beginning of the end approached, both parent birds developed individual, what we might call suggestive dances, or more authentically, instinctive nervous adumbrations of imminent activities. These were most pronounced in early morning. The male has arrived, made one or two futile forays into the swirling neblina and returned to his perch. He now goes through a frantic jigging, striking at the stub, rubbing his beak sideways on the bark, and slowly revolving, so that he may make three or four complete circles on the minute perch. Then he scans the valley, bobbing continuously, and takes off again. Meantime the female has arrived, and shows her eagerness for food for her offspring by a similar pirouetting, only she keeps up a steady picking at the splintered stub end, an assumed plucking and tearing of imaginary prey, also turning around and around on her perch. Again and again at high points of tension, when swoops have failed or the young are yelling with unusual vehemence, these two little performances take place. War and food dances are not confined to savages, and for occupational hints, Simon Stylites could have learned much from bat falcons.

Curiously enough, when the female is waiting for the return of her mate with food she never bobs, only turns her head with quick movements, sideways, up and down, watching every bit of sky. The male bobs most energetically when from his perch, he searches for possible prey. The young birds bob every moment of their waking hours, and may nod in their sleep for all I know.

It seems reasonable to think of this pair of fierce little hawks, being multiplied by two as we watch, as the center of a murderous whirlpool, their beaks and talons against every other bird. Actually the scene conveys no such catastrophic appearance. Soon after the young birds were hatched we had evidence of the close guard and strict watch kept by the parents, when a turkey vulture soared low

in front of the laboratory. The female falcon dived straight upon the innocuous buzzard, and struck again and again, sending the vulture into the valley at top speed. A few days later both parents united in an assault upon a black Brazilian eagle, who rolled sideways, and struck back but, to my eyes, without enthusiasm or apprehension.

A few meters away from the hawks' tree a colony of giant orioles built twenty-seven nests and carried on their normal activities, while parrots, parrakeets, trogons, toucanets, and green jays flew, perched or nested near by, none of them paying the slightest attention to the small hawks. The fear generated by a sudden dive, snatch, and carrying off of a small bird was brief and circumscribed, similar to that following the discharge of a gun. Birds in the vicinity became silent and crouched on their perches, but any prolonged effect of the pointblank, instant tragedy was confined to the possible mate or young of the victim.

On the fifth day of May the last visible tufts had drifted to wherever all cast-off down goes, and the throat and three-quarter collars were clear, bright rufous. For the first time Bob put his feet on the very outer rim, leaned forward, and looked down the fifty feet or more to the jungle floor. Then, like a bather whose toes have encountered icy water, he hastily drew back and dived in behind his sister at the rear of the nest. After feeding the young, the mother hopped to the rim, leaned forward, dropped with closed wings, and after about three of her lengths, opened her wings and parachuted in full impetus of flight. It looked so smooth, so easy to me, and probably to Bob and Nod who followed her to the edge, flapped, looked, bobbed and—sidled back into the safe, comfortable hollow.

We got thoroughly tired of the imminent but never actual flight of Bob. His sister hung back and gave him the whole stage, but day after day his life was a succession of almosts-but-not-quites. It was devastating to watch, and his appalling indecisions were contagious. I experienced the same "gone" feeling as I did years ago, at an acrobatic clown in vaudeville, who, perched on a chair on top of six small tables, teetered farther and farther and farther, until the nerves of the audience were almost ready to snap, before he actually toppled backward.

The climax came on the tenth of May—the fateful day marking the break-up of the nesting. At dawn I was glued to the binoculars and saw the female bring a swift to the nest. She balanced on the rim before beginning to pluck, and gave me a clear view of one of the rarest of these birds, the white-eyed swift, *Cypseloides cherriei.* Only three specimens had ever been taken before birds began striking at night against our laboratory windows. Here, in the talons of the falcon was the eighth swift to be seen by human eyes, although, as far as we were concerned, it was as insulated and inaccessible as were the deep-sea fish which I once watched swim past the windows of the bathysphere. Every marking, through the twenty-power lenses, was distinct, before the plumage began to fly and the body to pass down the throats of Bob and Nod. To the ornithological me it seemed a regrettable but worthy going-away present.

As happens sometimes in over-anticipated changes, the actual crisis came and passed almost unnoticed. I left the glasses for a few moments and when I returned I saw, without emotion, the female leave the nest. When too late, I realized it was Bob who had dropped from the rim, the sole remaining bird being conservative sister. I wondered if Bob's heart, lungs and all the rest had seemed to rush up into his head—my own sensations on my first parachute jump. I swiveled up to the candelo perches in time to see the youngster make a crash landing—a messy five-point landing with outspread wings, tail and legs—in a clump of air-plants. Slowly collecting his limbs and their feathers, he took off again, fluttered waveringly to his mother, upset her, and clung with agonizing flapping to her perch, and finally made it. He now did three things—looked at distant Lake Valencia on the horizon, chittered *ke-ke-ke,* and bobbed. Life had really begun.

If anything, Nod was more afflicted with hypsophobia than her brother had been, and we gave up watching her and concentrated on the more interesting acquisition of various instincts by Bob. On May eleventh and twelfth the female continued patiently to feed the remaining nestling, and this was more than Bob could stand. He actually returned, took a swallow away from her, and cowered over it in a corner before he tore it apart and devoured it. Later he climbed up the slanting side of the hollow and before he flew, soiled Nod's plumage with a shower of lime. He had experienced only twenty-four hours of freedom, yet in this short time he had lost the mutual, not unfriendly sharing of food, as well as all sanitary

instinct. Nod left on the thirteenth but returned for the three succeeding nights, an unheard of habit for hawks. It happened that her first post-nursery meal was also unusual—a mockingbird, a bird wholly alien to these cloudy, cool, uplands, and which, unless it was migrating through the pass, must have necessitated a six-mile flight far down the valley.

The first flight of Bob was wholly instinctive, the only preparation being abortive flapping. I was keen to see how he and his sister would master the very different, complex business of life—the capturing of living prey. Up to this time the male had caught every item of food and given it to or had it taken by the female. He brought his bats and birds to the nest while she was brooding the young birds, but when she was free to leave her duties for a time, he never again visited the nest. As far as I knew he had never even seen his offspring, but now he had no choice. Both young birds followed him about, eternally chittered at him, and mobbed him when he appeared with food. From now on the female joined in the hunting.

WHILE IN GENERAL the plumage in both old and young is identical, yet the latter could be distinguished at a glance by the brighter colors, the green instead of yellow eye-ring and base of the beak, and the decidedly rufous, not creamy-white chin, throat, and collar. When two birds were simultaneously within the field of view, the great difference in size was a perfect indication of sex. So when we saw one falcon fly toward another and actually knock it off its perch, we could say with confidence that Nod had been roughly dislodged by her mother, or Bob by his male parent. At first this summary treatment resulted only in a wobbling flight to another perch, but after a week the young birds followed, circled and made futile swoops at their parents and one another. This last activity took place frequently while both parents were away hunting.

Then we saw the young falcons slow up in midair, and reach out with their talons at some invisible object, such as a leaf, and later make wholly ineffectual attempts at big yellow butterflies, migrating down the valley. When the old birds attacked and drove off a vulture the youngsters tagged along in the rear and chittered fiercely.

Fifteen days after leaving the nest Bob took a swallow from the talons of the male in midair, and promptly dropped it, whereupon the terrified bird took off at full speed, apparently unhurt. The male flew up to his perch, looked down at his inept offspring, and chittered softly, perhaps conveying plenty in falcon talk. The great candelos shed their leaves in June, and the falling bits of yellow made good targets for both young birds. A closer approach to reality were two wing feathers joined together from the body of a swift which Nod was plucking at the top of the tree. Bob dashed after them as they fell, and made his first good catch. He brought them to his perch and made a great show of tearing at them, finally dropping them in turn, and actually taking after them a second time. This time he missed. The latest performance was a real pursuit of a swallow in front of the laboratory, but the ease with which the pursued bird dodged the amateur attack was laughable. Bobby side-slipped and missed by a hundred feet.

To see one of these small hawks perched on its favorite stub high above the jungle, looking every-

Limón Valley, hunting area of the bat falcons. (Photograph by Jocelyn Crane)

where, seeing so much more than the human eye in the hemisphere of the sky, launching out into the thin air, circling and swooping at will, we think of it as a happy hedonist. But as we watched the falcons day after day, doubt began to creep in. The daily routine of one of the adults was almost unvarying: arrival at 5:30 or thereabouts, an hour spent in watching, preening and bobbing; disappearance for one or two hours; return with bird or bat which was plucked and devoured; sitting quietly on the selfsame favorite perch, watching and preening for most of the day, with one or two short flights. Then, at three or four in the afternoon, another killing and dining, and then, about half past five o'clock off to some roost for the night. If I had my choice, I should prefer to be one of the scatter-brained, screeching parrakeets who spend their lives rushing back and forth, always in multiples of two, and telling the world what a grand time they are having in life.

As day after day passed, and there seemed to be no end to the continuous stream of hummingbirds, tanagers, and swallows following one another as fodder for this insatiable quartet, our interest began to slacken. Our sympathies shifted to the remaining small birds, for we were watching many other nests and we were not wholly sanguine of the safety of prospective fledgling trogons and flycatchers.

Yet, to be honest, we must carry our sympathies to logical conclusions. The feelings of our entomologist would be tried to the utmost could adequate magnification make real to him the unique insects, the new species and genera going down the throats of the many flycatchers in the Rancho Grande jungle. And some of this prey, in turn, such as predatory wasps, must not be held guiltless when we consider the unfortunate caterpillars which they paralyze as food for their grubs. And so, ad infinitum. Only size, ignorance, and superficial sentimentalism of the onlooker is concerned. Yet I am glad to be larger than a bat falcon, less ignorant than a flycatcher, and with considerably more sentiment than any known wasp.

In spite of the absorption of about six hundred bats and small birds as nutritious vitamins by the four falcons, there seemed no hint of the unbalancing of bird life around Rancho Grande, and we knew that much of the prey had been caught in other zones, and brought almost from the horizon.

It seemed reasonable that the six species and many individual hummingbirds had been taken as they fed on the insects visiting the lofty blossoms of pomerosa, orchids and araguanay, but now that the months of the bat falcons were past, the flowers were crowded as ever with these marvelous bits of bird life. The jungle trees sent forth as many brilliant flashes of color, songs, and choruses as before. The rains were late and nesting was delayed, for insects were still in moderate numbers. These were the only falcons nesting for many miles around, and we knew that they were one of the necessary checks upon the evils of overpopulation of birds, cruel as it sometimes seems to us. It is such elimination of the weaker which, through the ages, has insured strength and health to the infinite number of surviving organisms on the earthly tree of life; keeping fit the forebears of living birds—and of ourselves, virile for meeting the activities of successful living and survival.

As our sympathies pendulum in the direction of our living bird fauna, we begin seriously to consider several unaimed discharges of a shotgun as a hint for the hawks to shift to new hunting grounds. Simultaneously comes the realization that, to be consistent, to give equal balanced weight to our sober dictum of overpopulation, we must apply it to our falcons. Before another year has passed it is probable that unknown dangers will have eliminated either both parents, both young, or one of each, keeping the race within healthful bounds. We endeavor to put away from us the thought of Bob or Nod left to forage for themselves before they are ready, or of the patient, devoted parents losing out in the game of life and death.

Our last view of Nod was a happy one. Father, mother, and brother were off somewhere in the jungle, sheltered or not for the night. Nod was huddled cozily in the old candelo hollow, safe physically from the alternate rain and driving, neblina fog. We hoped, rather against the possibility of avian psychology, that she was also warmed with a glow of pride, for this day, at last, she had caught her first live bird, a violet-eared hummingbird. The tiny being had afforded only a soupçon of nourishment, but it symbolized a safe future in the battle of life.

A wisp of fog blotted out the small hawk and the black humid darkness of our last Rancho Grande night closed down.

Hindu Temples of Padang Lawas

Eastern approaches to the principal Si Toengir-Toengir temple (Bahal 1).

J. WYATT DURHAM

DECAYING MONUMENTS TO THE PAST GLORIES of the nearly forgotten Empire of Panei, the ruins of more than a dozen Hindu temples are scattered about the plains of Padang Lawas in Central Sumatra. Most of the temples stood near the junction of the Panei and Baroeman Rivers, and upstream along the Panei and its tributary, the Siroemambe, but a few are found some twenty-five miles to the south, along the Baroeman River in the region of the town of Siboehan.

When the author was working in the region in 1938 and 1939 the ruins were in fair condition, the brush and debris of centuries having been partially cleared away by the archeologist F. M. Schnitger when he studied the sites in 1935. By now, however, they are probably once again overgrown by brush and grass—in ten or a dozen years only, they would have lapsed back into the uncared-for state in which they had existed since some time between the 14th and 15th centuries, until Schnitger came with his workmen and their *parangs* (machetes) and *patjols* (mattocks).

The temples, known as *biaras* among the natives, usually face to the east. The buildings are commonly square, two or three stories in height, and built of brick. The principal edifice ordinarily has three or four lesser structures associated with it, all oriented so that the major openings face in the same eastward direction. Generally, the entire complex stands in a square courtyard surrounded by a brick wall.

Natives called the temples with which the author is most familiar Si Djoreng, Si Panjoetan (Si Pamoetoeng of Schnitger), and Si Toengir-Toengir (Bahal 1, 2, and 3 of Schnitger). The courtyard of Si Panjoetan is about 150 by 200 feet; the main temple within it has a base nearly 35 feet square and is slightly over 35 feet in height. There are, besides, four more subsidiary temples of various sizes within the enclosure. Schnitger reports that this was the largest shrine in Sumatra, but nevertheless it does not begin to compare with the Boroeboedoer of East Java. The largest of the Si Toengir-Toengir temples has a courtyard of roughly the same area as that of Si Panjoetan, but the main edifice, although taller, has a slightly smaller base. Si Djoreng is neither as large nor as carefully built.

Numerous reliefs adorn the temple walls, depicting various characters of Hindu mythology. Of like significance are the statues, frequently overturned or partially destroyed, which are found

scattered about the courtyards. Many of these isolated figures were carved from soft Pleistocene volcanic tuffs which cap the terraces here and there in the region, and are in consequence often badly eroded.

The character of the carvings and statues in and around the temples indicates that the religion practiced here was that of the Bhairawa sect, one of the most savage and cruel branches of Buddhism. Among this sect's customs was the sacrifice of living human beings. Priests ripped the victims open, cut out their hearts and drank their blood, then burned the bodies in flaming pyres. As the rituals progressed the priests gradually became as if intoxicated by these sanguinary draughts and the ceremonies wound up in orgiastic dancing. The name of the temple here called Si Panjoetan (or Si Pamoetoeng by Schnitger) can be translated as "The Tempestuous"—perhaps an indication of the demoniacal mode of worship once the liturgy of its priests.

It is a curious observation that, although these temples are constructed of brick, the present natives of the region are ignorant of brick-making, and build only with wood, bamboo, and palm leaves (except when they use more modern materials such as cement and galvanized iron).

An intriguing feature, noted several times, was the imprints of cats' and dogs' feet on the surfaces of bricks now loose and fallen. Apparently the animals had wandered or run across the freshly molded bricks while they were still wet enough to be readily imprinted by a light tread.

No bronze or gold statuary or ornaments were to be seen in or around the temples but Schnitger records that he recovered a few such pieces. That archeologist's explorations were limited, however, and so it is probable a good many such items could yet be found there. When the present author was in this region, reports were current among the natives that one of the *biaras* near Siboehan (probably Sangkilon of Schnitger) had been razed by fortune hunters looking for gold and silver. According to rumor, the vandals had removed large amounts of treasure. These tales being most prevalent among inhabitants of the village where Schnitger had trouble with the native raja regarding ownership of the few articles he found, it appears probable that such rumors were distorted versions of Schnitger's activities.

Scattered among the articles he found or reported upon was material constituting evidence enough to make Schnitger believe the temples were of various ages, dating from the 10th to the 14th centuries—the largest ones probably the oldest. Earlier authors had thought the culture dated largely from the 13th and 14th centuries. The oldest definite date, found on a piece of bronze statuary, was interpreted as 1024 A.D. Inscriptions discovered at Si Djoreng indicate that this temple was probably founded about 1179. Nevertheless, the ancient kingdom of Panei is mentioned in Chinese records of the 6th century under the name of Poeni. About the year 1000 this was the principal state of Sumatra; shortly thereafter it was conquered by the South Indian king Rajendracoladewa. During the following centuries it became famous for its splendid temples—until it was overrun by the armies of the East Javanese Empire of Madjapahit. After this second subjugation it rapidly declined in importance; when Europeans arrived in the 16th century the old kingdom had sunk into oblivion.

When Panei was at the height of its glory, the region of Padang Lawas must have been rich and populous to have afforded the numerous temples, but now the area close around Si Panjoetan and Si Toengir-Toengir supports but a small population and most of the lands are uncultivated. Herds of half wild carabao or water buffalo range over much of the region; tigers are common—but usually not of the man-eating variety; and elephants

Typical view in Padang Lawas. The line of trees marks the course of a stream.

Photographs by the Author

are fairly abundant within the jungle proper, the edge of which is distant some five miles to the east of Si Panjoetan.

Today, the grass-covered plains and low rolling hills of Padang Lawas with their vestiges of a former populous kingdom are an anomaly in the midst of jungle-covered lowland plains and mountains. Covering an L-shaped area along the east side of Central Sumatra's Barisan Mountains, the region denoted by the name Padang Lawas (which means "wide grasslands") extends for about eighty miles along the mountain front including the upper course of the Baroeman River and its tributaries, the Panei and the Siroemambe.

Except along the stream courses, trees are few and far between. Apparently the region gets as much rainfall as the surrounding jungle-covered areas, while the same geologic formations and types of soils extend far beyond the confines of the grasslands. In explanation of this non-forested area, it has been suggested—probably not without reason—that during the time of the kingdom of Panei the region was so extensively deforested for cultivation that it has not yet recovered. The men who lived here in those days have long since disappeared, but their works still show on the land.

ABOVE—LEFT: *Raksaras and headless sitting elephant at Si Toengir-Toengir (Bahal II). The face of one of the Raksaras has been destroyed.* RIGHT: *The Bhairawi statute of Si Panjoetan. Probably the image of a queen who had been initiated into the Bhairawa cult.*

BELOW—LEFT: *One of the Si Toengir-Toengir temples (Bahal I) from the rear.* CENTER: *Ruins of part of Si Panjoetan temple with statues in the foreground.* RIGHT: *One of the small statues at Si Panjoetan.*

Our American Deer

Columbian Black-tailed Deer, *Odocoileus hemionus columbianus* (COVER PICTURE).

For several summers in the 1920's a fine old buck lived near the Forest Service fire lookout on the summit of Hayfork Bally, Trinity County, California. The lookout was manned by an old mountaineer and prospector, Charlie Farmer, who put out salt and was rewarded by having many deer, including this old buck, as daily visitors.

The antlers of Columbian black-tailed deer are similar in conformation to those of the closely related mule deer, but the former is a much smaller animal; its ears are not as large, proportionately; the tail is broad and dark on the entire upper surface. Black-tailed deer occupy a range along the Pacific slope from southeastern British Columbia to southern California. In certain regions the ranges of black-tailed and mule deer overlap during the critical rutting season in the fall. The two kinds interbreed freely in such areas, producing fertile hybrid offspring. For this reason most mammalogists consider the two members of the same species.

Rocky Mountain Mule Deer, *Odocoileus hemionus hemionus* (PICTURE, PAGE 16).

The largest deer in North America owes its name to its large, mule-like ears, but more distinctive field marks are the white rump and the black-tipped tail clearly shown on the fawn in the photograph. Range: throughout the Rockies and along the eastern slopes of the Sierra Nevada and the Cascades.

Mule deer customarily summer at high elevations, dropping down in winter to the foothills. Maintaining adequate forage on winter ranges is one of the most critical factors in mule deer management. Summer forage is generally abundant at higher elevations, but when heavy snows drive them into the valleys, mule

deer become competitors of domestic stock on range and pasture lands. Too often the result is severe overgrazing with its aftermath of erosion and starvation. Deer herd management attempts to keep numbers in balance with available feed at critical seasons. Long established custom has decreed that only bucks may be legally shot; this adds to the management problem by building up the numbers of potential breeding females. Game managers advocate legal hunting of does in certain areas to keep the total population within limits imposed by amounts of available winter forage. This system of management is producing satisfactory results in many states.

White-tailed Deer, *Odocoileus virginianus* (PICTURE, PAGE 17, *shows a mother and her pair of week-old fawns*).

Most widely distributed of American deer, white-tails range throughout the eastern and central parts of North America and occur sparingly in much of the west. Their continued existence over a large proportion of their original range is evidence of their adaptability to environmental changes brought about by settlement and agriculture.

In California white-tails probably were native only in the northeastern part of the state and, even there, never common. There have been no recent California records, although these deer are still seen in eastern Oregon and elsewhere in the western states.

White-tails are skulkers, frequenting thick cover along stream beds and in canyon bottoms, rarely seen in open forest and brush land where both mule and black-tailed deer are common. If you see one frightened, you will know how the species got its name. Bounding away with wonderful grace, he will show the white underside of his long tail, straight up and waving like a banner. No mistaking him now for either black-tailed or mule deer, both of which carry the tail down and characteristically run with a peculiar series of high, stiff-legged, bouncing jumps, all four feet seeming to leave ground at the same time—quite different are the white-tail's long, flowing bounds.

—In Three Photographs by Paul J. Fair

Flight INTO TOMORROW

ROBERT CUNNINGHAM MILLER

NEAR MIDNIGHT IN MID-PACIFIC, on January 30, 1949, a plane of the United States Military Air Transport Service, its four motors purring in steady rhythm, crossed the Equator at 8,000 feet and entered the Southern Hemisphere. The pilot, by twisting his neck a bit, could still see Orion high in the northern sky. Before him and a little to the left, the Southern Cross beamed a serene and comforting welcome.

The pilot, however he might thrill to the pageant of the stars, came back quickly to his dials and controls and the business of the moment. There was a landing to be made. Far ahead and below he could see a beacon flashing. That would be Canton Island. He turned and spoke to a sergeant.

Shortly the lights flashed on in the cabin of the plane. Twenty-six passengers blinked into reluctant wakefulness as the sergeant moved down the aisle. "Seats straight up. Fasten your safety belts. No smoking, please," he intoned from the ritual of flight.

"Air travel will never come of age," grumbled a geologist, "until they can make a landing without waking all the passengers up." He fumbled with his safety belt until, as sleep left him, he found he had one half of his seat-mate's belt and was trying vainly to link it to his own. Suddenly he came wide awake. "This is Canton Island," he said. "I've never been here before." He fastened his seat belt with a click and peered out the window at the beacon that came steadily closer.

The geologist put his fingers in his ears, then took them out and swallowed rapidly. The sudden change in pressure as the plane came down had made him deaf and uncomfortable. He yawned widely, not from sleep now, but to equalize the pressure on his eardrums.

There was a bump and a squeak as the pilot eased the plane down onto the runway—the first touch that started the landing wheels rolling. A moment later he eased it down again and the wheels, spinning now, were prepared to take the load. "Every time you land a plane like this," the co-pilot stated, "you use up as much rubber as you have on all the four tires of your automobile." The passengers thought about their automobile tires and were impressed.

"Please keep your seats until the tail-prop is in place," again the sergeant intoned his ritual, and the passengers sat quietly with folded hands. Then there was a little shuffling about at the rear of the plane, indicating that the door was open and people might get off. Abruptly we found ourselves on Canton Island, a barren atoll that countless millions of coral polyps, collaborating with time and action of the waves, had built up a scant few feet above the sea, and that sun-helmeted men with bulldozers had leveled into a landing strip for trans-Pacific planes.

It was dark, but the white coral sand made a path that wandered off into surf and starlight. The wind was steady, powerful, and warm. Stunted coconut palms alternately pushed against the wind, then waved their fronds dejectedly to leeward. The temperature at 1 A.M. was 72° Fahrenheit, the humidity close to saturation. As long as one stood in the wind he was moderately comfortable. Out of the wind, he would run a finger around inside his collar while beads of perspiration formed upon his brow—Canton Island is hardly more than a stone's throw south of the Equator.

The open door of a one-story building gleamed at the edge of the airfield, and like moths we headed for the light. Looking back, we saw the plane standing tall and eerie in the darkness, its shining armor reflecting the points of light that marked the runway.

As we approached the building we noted in the shadows three dark-skinned, fuzzy-haired gentlemen wearing sarongs. They stood side by side with folded arms, impassive, silently observant, while the warm midnight wind whipped their skirt-like garments about their thighs. They were Gilbert Islanders, diligent and faithful employees of Pan-American World Airways.

"Such characters!" whispered a meteorologist from the Atlantic seaboard as he sidled nervously past them and hastened into the airport office, where he was reassured by the presence of English-speaking white men. He would have been considerably more startled had he looked out ten minutes later to see the Gilbert Islanders in their sarongs busily refueling the plane on which he would shortly take off once more into the tropical night.

Inside the airport building the passengers took stock of themselves and each other, some two

Auckland University College, where the first week's sessions of the Pacific Science Congress were held.

dozen American scientists, hot, damp, sleepy, wrinkled and needing a shave—delegates of the National Research Council of the United States of America en route to New Zealand for the Seventh Pacific Science Congress.

"Wouldn't the National Research Council be proud of us now?" a zoölogist said, grinning as he mopped his brow with one hand and stuffed his shirt-tail in with the other.

The latter undertaking was accelerated upon the appearance in the room of the ubiquitous American girl—in this case the wife of the airport manager. Social life being what it is on a coral island, she had waited up for the plane to come in. Cheerful, vivacious, conversational, she restored the morale of the party faster than a magnum of champagne. "Remarkable, isn't it?" an anthropologist observed as we boarded the plane once more. "People may differ, customs may differ, climates may differ, but the American girl is equally good wherever you find her." We nodded assent and thought of the young lady gratefully. We did not even know her name.

Photographs by the Author

Back in the plane, we fastened our seat belts and waited as the pilot revved up one motor and then another until, satisfied, he gunned them all, released the brakes, and roared down the runway. In a few seconds we were air-borne and looking down again on tiny, windswept Canton Island. Its few pin-points of light faded out in an ocean of darkness and we winged our way southward, suspended between sea and stars.

Presently dawn was on the horizon, then the sun came up. "At 1734 GMT crossed the International Date Line." This terse, penciled memorandum from the pilot was circulated among the passengers. "What's GMT?" inquired a botanist. "Greenwich Mean Time," replied an oceanographer. "Well, what time is it here?" "5:34 A.M., just twelve hours later." "Twelve hours earlier," a geophysicist corrected. "All right," agreed the oceanographer, "have it your own way. Whether it's earlier or later depends on whether you are one foot east or one foot west of the Date Line." "What day is it?" This was a more vital problem. After sleepy discussion we decided that yesterday was Sunday, from midnight to 5:34 A.M. it had been Monday, and today was Tuesday. "Doesn't make sense," the botanist argued. "How can it be February 1 here when it's January 31 in San Francisco?" Nobody could think of an easy answer. "A new day has to start somewhere," the oceanographer suggested. "We have just flown over into tomorrow." "You try writing up your diary and see how you come out," retorted the botanist.

The argument might have gone on and on, but the sergeant interrupted. "Fasten your seat belts. No smoking, please. We will be at Nandi Airport in Fiji for one and a half hours. The temperature outside is 80 degrees."

FIJI! Storied islands of adventure. And we were going to be there only an hour and a half!

A quick breakfast at the airport, and everybody rushed out and began taking pictures. One photographer was maneuvering about a thatched hut to avoid showing the electric wires that ran to it from an adjacent post, while another thought the electric wiring the most significant part of the picture. Two members of the party persuaded a native policeman to pose for them in his bright blue coat and white *sulu* (Fiji version of a sarong). Two others were surreptitiously and amusedly taking pictures of their companions taking pictures—a process which, theoretically at least, might proceed to infinity. Before it had gone that

Street scene, Christchurch. New Zealand has a small but growing population.

far, a shout went up that the plane was ready to take off, and we all ran and climbed in for the final lap of our journey.

Generally we were above the clouds, and only occasionally could see the water. Late in the afternoon we sighted land and presently were at the Auckland airport—36 hours and 18 minutes of flying time from San Francisco. Customs and immigration officials, polite and helpful, cleared us in record time. Then we had tea at the airport. We were in New Zealand!

Auckland, as befits a modern city, has its airport 17 miles from town. We had a chance to see quite a lot of the countryside and even to make some observations on the native vegetation and bird life before arriving at our hotel.

There was a certain amount of confusion in finding rooms, stemming from the elevator's being called a "lift" and the second floor being the first floor. This is universal in New Zealand. They don't start counting floors till you are one flight up—or, if there is a mezzanine, you go up two flights to reach the first floor!

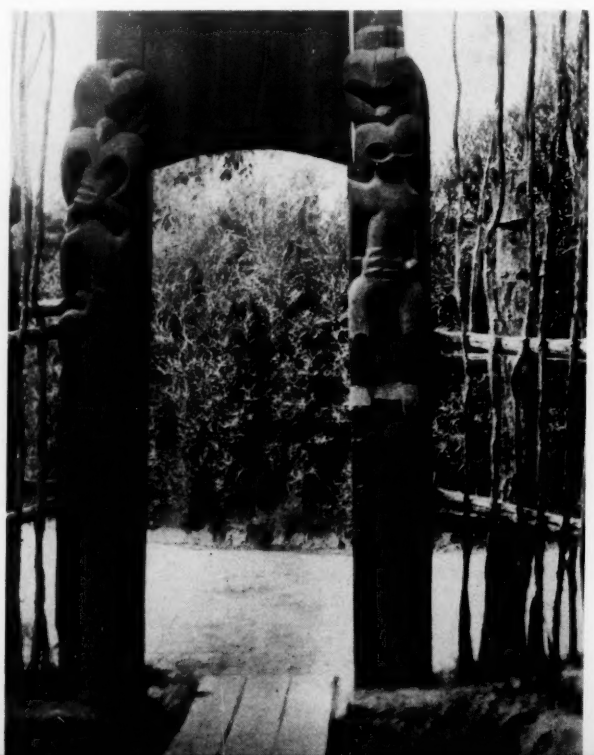
Had we crossed the North and South Pacific, the Equator, and the International Date Line only to become hopelessly lost in the upper stories of an Auckland hotel? No! We kept our heads and, through a combination of firm resolution, counting on our fingers, and the assistance of two clerks and a porter, found our rooms in time to dress for the opening reception of the Congress.

This was a gala occasion, held in the City Hall, where the Mayor, in his splendid robes of office, greeted us in a graceful address of welcome. During a pleasant social evening we had an opportunity to become acquainted with our New Zealand hosts and to meet old friends from near and far. Two hundred overseas scientists from various quarters of the world had converged on Auckland for the Congress, making up the largest overseas attendance at any Pacific Science Congress to date. With some 400 New Zealanders present, the total registered attendance was just over 600.

Scientific sessions were held at the Auckland University College from February 2 to 8, and at the University College in Christchurch from February 16 to 22. During the week between sessions delegates were enabled to visit points of interest on North Island, and following the Christchurch session they were given a similar opportunity on South Island. Thus, in addition to achieving the scientific purpose of their visit, they saw a good deal of New Zealand, with its hospitable people, interesting plant and animal life, and striking scenery, including hot springs, geysers, volcanoes (one of which considerately erupted for the visitors), and the justly famous Southern Alps.

It is obviously impossible to summarize a program that included 500 technical papers on subjects ranging from geomorphology to public health. The best that can be hoped is to convey some impression of the scope and character of the Congress, and to mention a few of the major topics of discussion.

This, the Seventh Pacific Science Congress, was the first of such gatherings to be held since the war. Previous Congresses had convened in Hawaii (1920), Australia (1923), Japan (1926), Java (1929), British Columbia (1933), and California (1939). The Congresses are of an official character, being sponsored by the government of the host country



Gateway with Maori carvings, Rotarua, North Island.

Franz Josef Glacier, in the Southern Alps, contrasts strikingly with lush, subtropical vegetation.

through one or more of its scientific agencies. Invitations to the Seventh Congress were issued by the Royal Society of New Zealand, with the approval and support of the New Zealand Government.

A quick glance at the program would suggest that the following topics came in for a pretty good working over: volcanoes, earthquakes, tidal waves; thermal areas, including the possibility of their development as a source of power; meteorology as related to Pacific flying; climatology of the Pacific area; agricultural and fisheries resources; exploration of the sea; whaling; soil conservation and reforestation; anthropology and ethnology; tropical diseases; nutrition and dental health; improvement of the condition of dependent peoples.

The earnest interest of the New Zealand Government in the discussions was indicated when, following a criticism of its policies in the Cook Islands and Western Samoa, the Prime Minister, instead of rising to the defense, stated that the matter would be studied "with a view to translating the criticism into beneficent administrative action."

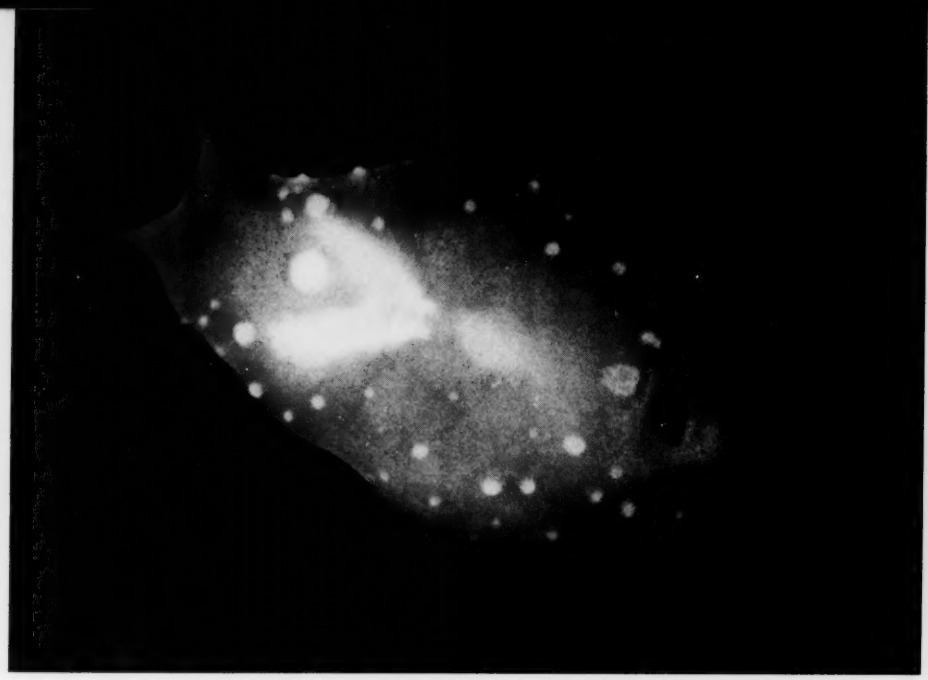
Persons who attended this and previous Congresses (the present writer has attended three) felt that the New Zealand Congress reached a new high in good fellowship, good will, and serious accomplishment. With delegates present from at least twenty nations, members of the Congress had a chance to renew old friendships, build new ones, and inform themselves on scientific progress in the Pacific area during and since the war years. It seemed symbolic that New Zealand was just a little west of the International Date Line. In our discussions we were moving into tomorrow.

Last but not least, the Congress provided an opportunity for the Managing Editor of *Pacific Discovery* to talk things over with one of his Associate Editors whom he hadn't seen for a twelvemonth. Dr. J. L. Kask attended the Congress as a representative of the Food and Agriculture Organization of the United Nations. By one of those coincidences that leave students of probability theory a little dizzy, he and the author turned up in adjoining rooms at the Excelsior Hotel in Christchurch. It seemed one of the most improbable places in the world for two of the editors of *Pacific Discovery* to meet. Or was it?

WOODBRIDGE WILLIAMS

THE Enigma of Mission Bay

PHOTOGRAPHS BY THE AUTHOR



IN MISSION BAY, CALIFORNIA, within the city limits of San Diego, there exists one of the most curious animals in the molluscan world. It is called *Chlamydoconcha orcutti,* and it closely resembles certain gastropods—a small cowry, for example, with its papillose mantle thrown over its back, or a white sea slug, one of the nudibranchs. But in reality *Chlamydoconcha* is a clam, a bivalve,* with an internal rudimentary shell buried in that top layer of tissue covering the animal which is technically called the *mantle.* It is one of the few species of clams which you could say have crawled out of their shells—this one, in fact, seems to have swallowed its shell; it might be called a "naked clam."

Although it is not the only clam whose shell is of little value to the owner—there is a small group of clams with degenerate shells which are parasitic in other marine invertebrates – *Chlamydoconcha* is peculiar in that it depends, as far as we know, entirely upon its own resources for survival and sustenance. In this respect its evolution parallels that of many non-parasitic snails whose shells have almost disappeared, or have become internal, among them garden slugs, the daintier sea slugs, and the grotesque sea hares.

Chlamydoconcha has not lost all of the organs typifying a clam. For example, it possesses a hatchet-shaped foot that protrudes from a slit in the ventral surface. The foot is a clam's means of locomotion, and the foot of *Chlamydoconcha* differs little from that of a cockle or its related bivalves. When *Chlamydoconcha* travels over a stretch of sand, this foot is stretched forth to gain an anchorage, then with a muscular contraction the entire animal is pulled forward, leaving behind a V-shaped track in the sand. This procedure results in a jerky gait characteristic of the movement of most clams. Still, unlike the cockle, but like the more sessile mussel, *Chlamydoconcha* possesses a large gland at the base of the foot which can spin an elastic *byssus,* or tuft of filaments, whose tough strands are almost as fine as those of a spider web. This byssus is used for temporary anchorage in exactly the same way as that of the mussel.

Upon the dorsal surface of this curious creature are two openings, or orifices, one at each end of the animal. When the clam is expanded, these resemble tiny funnels emptying into the somewhat amorphous mass of translucent white tissue. The front orifice opens near the mouth, the back one at the anus. Plainly visible in the living animal are several of its internal organs, such as the beating heart and the viscera, that differ from those of most clams in being no longer enclosed by the shell; in *Chlamydoconcha* these organs lie behind the rudimentary valves of the shell, which appear through the mantle as two opaque white streaks.

* To remind the reader of relationships: the phylum Mollusca of the Animal Kingdom is divided into the classes Amphineura, chitons; Gastropoda, snails, slugs, whelks, etc.; Scaphopoda, toothshells; Cephalopoda, squids, cuttlefish, octopi, etc.; Pelecypoda, bivalves—clams, oysters, scallops, etc.

LEFT: *Upper surface of Chlamydoconcha, extended. The V-shaped rudimentary shell shows plainly, although it is buried in the fold of the mantle. The little knobs covering the mantle surface are papillae. The clam's foot protrudes through a slit in the bottom of the hood formed by the mantle.*

RIGHT: *Lateral (side) view of Chlamydoconcha showing the foot extended. The clam moves by thrusting the foot forward to take hold of the ground, then pulling its body forward over the foot.*

The valves have pulled apart so that they are no longer hinged. At the apex of each valve is a tiny bubble of a shell—the persistent embryonic shell—which perhaps in an early stage encompasses the entire animal.

At maturity *Chlamydoconcha* is about one and a half inches long and an inch wide. Size and shape vary from moment to moment, however, as the clam silently, spasmodically, sighs and heaves when it expels sea water from the body cavity and then refills itself to the point of turgidity.

When discovered beneath rocks, where they have been found clinging to dead shells of old rock oysters (*Chama* sp.), the animals are brilliant white and their size makes them easily discernible. But their superficial resemblance to sea slugs may be the reason they have so seldom found their way into the pickle jars of southern California's swarming shell collectors. Chances are they have been seen many times, but have been mistaken for some other more common marine invertebrate. In fact their presence along the coast has been for many years almost legendary.

Between 1882 and 1884 Charles Russell Orcutt, San Diego naturalist, eccentric, and one of the most assiduous collectors of his time, found these clams among the rocks at the mouth of Mission Bay. He sent his finds to Dr. William Healey Dall, then Curator of Mollusks in the U. S. National Museum, who described them as a new species. Dr. Dall, in fact, considered them unique—grounds for adding a new genus and family of mollusks to the animal kingdom. He called the species *Chlamydoconcha orcutti*—the generic name (Greek, *chlamys,* mantle, and Latin, *concha,* shell) referring to the mantled or cloaked shell. Dr. Dall sent one specimen in alcohol to Felix Bernard, a French biologist who specialized in the study of these clams with vestigial shells. Bernard made a thorough description of the anatomy of *Chlamydoconcha* from the one specimen, publishing it in 1897. To the present author's knowledge this was the last piece of original research on the molluscan enigma from Mission Bay, principally because of the lack of specimens.

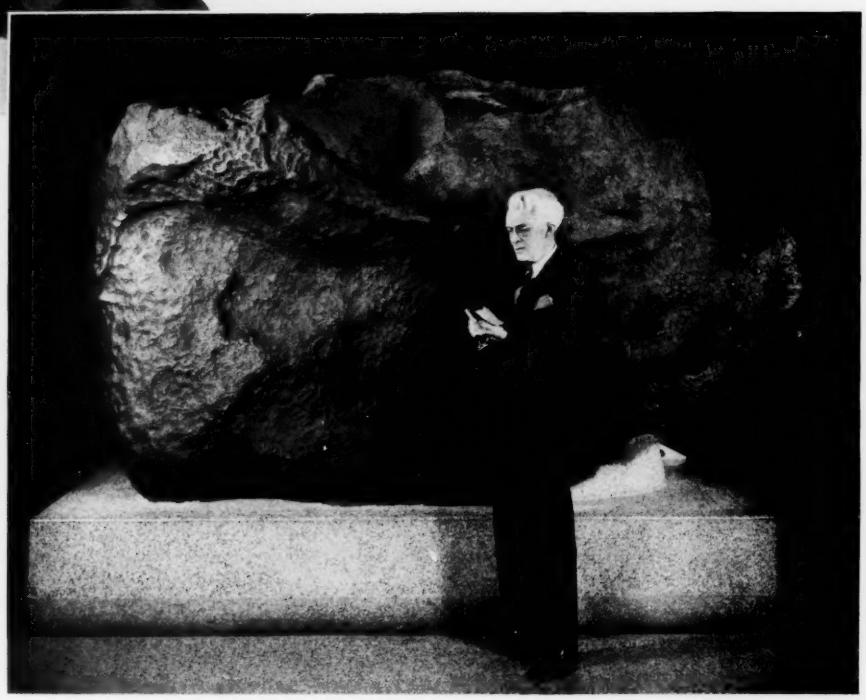
The city of San Diego is now converting Mission Bay into an aquatic park, but it is gratifying to know that *Chlamydoconcha* will not become extinct if its habitat there is destroyed by the dredges, for it has occasionally been taken at other points. The schooner *E. W. Scripps,* of the Scripps Institute of Oceanography at La Jolla, dredged one specimen off Imperial Beach, San Diego County, on kelp. Mr. Percy Barnhart, when curator of the museum at Scripps, collected one specimen at Bird Rock, La Jolla. Dr. Harold Heath of the Hopkins Marine Biological Laboratory reported *Chlamydoconcha* as rare under rocks in the intertidal area of Monterey Bay.

The accompanying photographs give better than words the appearance of this strange creature. The specimens were collected last year in Mission Bay, and photographed alive at the Scripps Institute of Oceanography.

Meteorites are bombarding the earth. How good are your chances of seeing one hit and finding it for science?

ABOVE: *Fifteen and one-half tons of nickel iron, the Willamette meteorite was found in 1902 about 19 miles south of Portland, Oregon. Cavities are attributed to oxidation. (American Museum of Natural History, N.Y.)*

RIGHT: *The "Ahnighito" or Cape York meteorite, iron, 36½ tons, is the largest in any museum. Peary found it in Greenland in 1895, and brought it to the United States. (American Museum of Natural History, N.Y.)*



Brickbats from Space

EARLE G. LINSLEY

ANY MOMENT, DAY OR NIGHT, a ton or more of rock or iron might come roaring through the air and—with blinding flash and earth-shaking impact—fall near you or me. Not too near, we should hope—yet it would be a rare and wonderful experience to observe a great meteor in transit close enough to be followed to its landing. Rarely indeed do real giants from space strike close to human observers—but when they do, they are something for the record, and they or their fragments are, if recovered, prized specimens for the museums and welcome material to students of the composition of extra-terrestrial matter.

What is the record? Let us look at an entry (this one reported by Dr. Lincoln LaPaz in November 1948):

Prairie Fireball

It was 4:55 on the cloudless evening of February 18, 1948, in Norton County, Kansas. In the

quiet before dusk a Mrs. Orville Manning and her son were walking in the back yard of their home on the large McKinley ranch. Suddenly they heard—as you might any day or evening—"unearthly whizzing sounds in the air above them." Observers spoke of being "petrified with astonishment, as, gazing upward they saw an angry, boiling cloud, showing occasional reddish streaks, blossoming out against the clear, blue sky."

Some twenty miles away, a shell shocked veteran was loading fodder. He (as he later reported) "crouched in a state of complete collapse while a cannonading, louder than any ever heard in Europe, beat down from the sky."

Ten miles east, two mares just about to be called in from the pasture "went berserk and crashed into a narrow canyon from which they could not escape, and were pawing blindly toward suffocation."

These are a few of a chain of experiences recorded and checked, under the direction of Dr. LaPaz, by representatives of the University of Nebraska and the Institute of Meteorites of the University of New Mexico.

Similar terrifying experiences were reported over several hundred square miles in northwest Kansas and adjacent parts of Nebraska. For a great stony meteorite had swept into the air over Kansas, burst into incandescence, and scattered its fragments over Nebraska farmlands. Its appalling noise drove thousands of people out of doors in Norton, Norcatur, and Oberlin, Kansas. They looked to the sky, terrified beyond any previous experience (some, perhaps, in the fearfulness of our times, imagined an atomic war had begun with no warning, and many war veterans were reminded of bombings).

A few observers saw the fireball whose screaming, roaring flight had amazed and terrified so many. The clouds it made were very high and long lasting, the flash bright enough to be observed and reported from Greeley, Colorado, 250 miles away. Radio was put in service at once; Civil Air Patrol and commercial pilots were questioned, and a flood of information collected.

Weather delayed the hunt for fragments until April, when the Institute of Meteorites began a carefully planned search. A farmer plowing his clover field turned up the first fragment. Areas divided into sectors were covered by individual searchers, who found many more fragments in both Kansas and Nebraska. Finally, on July 3 someone spotted a nearly circular hole about 6 feet in diameter and 6 feet deep on a Nebraska ranch. Full excavations revealed the meteorite, its lowest tip about 11 feet below the surface. It was the largest stone meteorite, so far as we know, ever seen to fall, of a type so rare there may be but few other occurrences known to the world. Where, and to whom, will it happen next?

One of the largest stone meteorites seen to fall was dug out of an 8-foot hole near Paragould, Arkansas. Falling February 17, 1930, it weighed 820 pounds. (Chicago Natural History Museum)

The Goose Lake Meteorite

Celebrated in meteorite history is the Goose Lake (California) meteorite. Did anyone see it fall? I was visited recently by an elderly man who saw, fifty years ago, a spectacle like that which astonished Kansans last year. It could have been the Goose Lake meteorite. Let Mr. B. Y. Bessac (now of San Bernardino, California) tell his own story of what he saw half a century ago from his home in Forbestown, Butte County, 16 miles east of Oroville:

"One evening in November 1898, about 9 P.M., I stepped into the back yard of our home. There was no moon at that hour and the sky was full of stars, but there were a few dim scattered clouds. The sky suddenly lighted bright as day, as though a great electric light had been switched on. In perplexed astonishment, I turned to look for the source of the brilliant light, and then I saw the sublime spectacle of a large meteor glowing with incandescent brilliance coming from the south by west and straight at me, as I thought. It seemed to be quite high—how high I could not judge be-

cause of its brilliance which baffled my senses. I gazed in awe and wonder as it came swiftly on. I turned quickly to take in a panorama of the south, west, and north. I looked down at the one main street of the town, and saw the buildings, doors, windows, sidewalks, and trees along the street, but I saw no people on the street, as they were indoors; then I could see a long stretch of the forest-covered Lumkin Ridge to the north and northeast that forms the divide between the middle and south forks of the Feather River four to six miles away, and many individual large trees stood out clear and distinct. I took all that in, in about a three- to four-second interval—by now it was getting close. Then I saw it was passing me seemingly about one quarter mile to the east of where I stood. I judge it was descending at the rather gentle angle of six degrees. From here on, as it moved swiftly away from me, I could better judge its course, which seemed to be about north by east."

After a carefully detailed description of the meteor, and speculation upon its probable speed and point of fall—excellent example of observation and valuable report—Mr. Bessac continues:

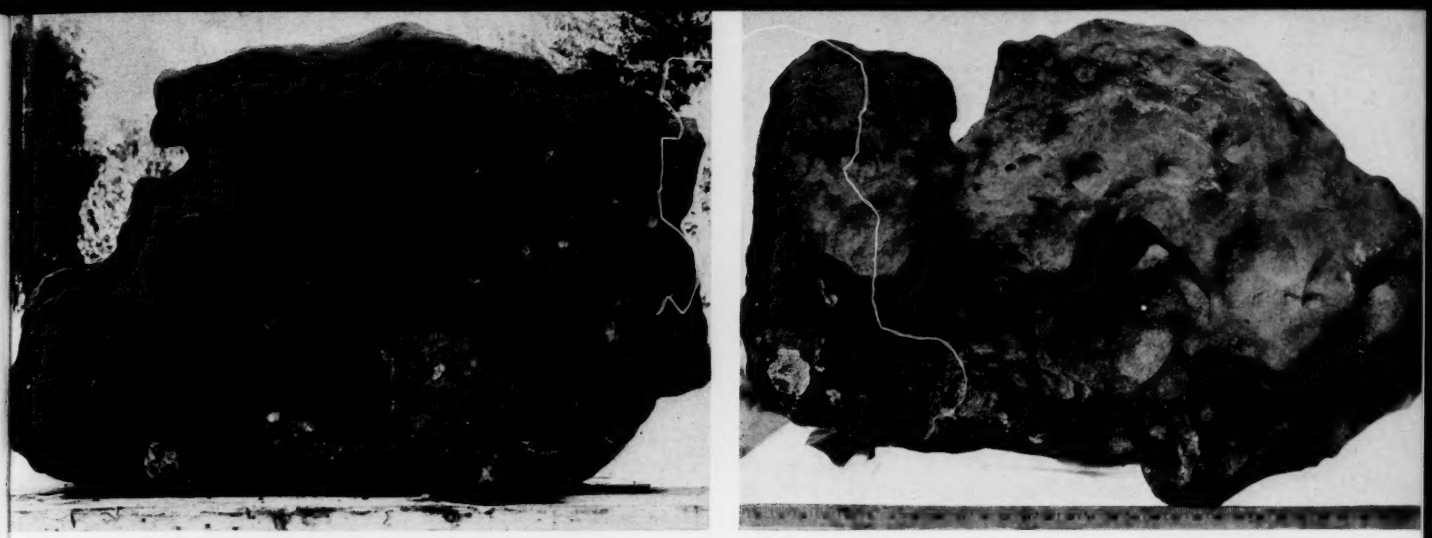
"Forty years passed. When I read in the newspapers in October 1938 of the finding of the Goose Lake meteorite, I was thrilled, and wondered if it might not be the large meteorite I had sighted, headed in the direction of Goose Lake, many years before." Ten years later, Mr. Bessac saw a replica of this, the largest meteorite ever found in California, on display in the Griffith Park Observatory, Los Angeles, and read the published description of it (by Dr. Frederick Leonard, Department of Astronomy, University of California at Los Angeles, in the *Griffith Observer,* January 1940). He was then prompted to draw a map of northeastern California showing the place of his 1898 observation, the plot and projection of the meteor's course as he judged it, and the point of the Goose Lake fall, and to write a complete description of what he had seen. His map supports his observation; he might very well have seen the Goose Lake meteorite in transit—his projected lines come very near the spot where the huge iron was found.

So it might have been that some fifty years ago a streak of dazzling light, a roar and a mighty crash, shaking lava beds and forest, heralded the fall of the Goose Lake meteorite. But it was a siderite or mass of iron and not a stony mass such as recently fell in Nebraska, so did not explode in fragments. We can only speculate, at present, on the probability that this was Mr. Bessac's meteor—but the evidence of his observation is temptingly strong.

Many who read this will remember having seen the original Goose Lake meteorite when it was displayed on San Francisco's Treasure Island in the 1939-40 Exposition. Its known history might well be retold here in the hope renewed interest may lead to other meteoritic finds.

In October 1938 three Oakland hunters, Joseph Secco, Clarence A. Schmidt, and Ira Iverson almost stumbled over what proved to be a mass of iron on the higher barren part of the Modoc lava beds, a few miles west of Goose Lake. Neither this northeastern corner of California nor any other particular area can be called a "good" hunting ground for meteorites. They might be found anywhere—recognition is the important thing. It happened one of these three men knew a little about meteorites.

Goose Lake meteorite as the author first saw it, lying on a Modoc lava bed. Note windswept area around it. The iron was polished on its exposed surface by wind-blown lava dust.



The Goose Lake meteorite. LEFT: *Weathered surface, the same as shown in the preceding photograph. This iron meteorite, or siderite, weighed 2,573 pounds when brought down to Chabot Observatory, Oakland, in 1939.* RIGHT: *Uppermost in this picture is the side of the Goose Lake meteorite which rested on the ground. Yardstick shows the iron to be nearly three feet long.*

Iron meteorites which are seen to fall, or are recent, show a burnt skin. Stony meteorites may be much disintegrated on the surface. The surface of this meteorite was almost mahogany color, with many pits. Some holes extended through the mass. No evidence indicated shattering of rocks by the fall, or that it had been buried and later uncovered. There it lay—possibly only for fifty years, possibly for centuries—until alert eyes saw it, and it rang under an ax with a sound different from that of surrounding rocks. The hunters knocked off a corner with difficulty and brought it out to an authority. His examination showed it to be of celestial origin.

The whole iron was taken out of the ground in May 1939 and brought down to Chabot Observatory, Oakland; from there it went to Treasure Island. After the Exposition of 1939 it went to the California Academy of Sciences, where three excellent facsimiles were made. Of these one is now in the Mineral Hall of the Academy; one is at Chabot Observatory; the other, already mentioned, is at Griffith Observatory. Returned to Treasure Island for the 1940 Exposition, the original Goose Lake meteorite was finally claimed by the National Museum (it had fallen in Modoc National Forest) and taken to Washington, D.C., for further scientific study.

That was the largest meteorite so far found in California, fifth largest for the United States. It weighed 2,573 pounds and its greatest dimension was just under three feet. Such iron meteorites, called siderites, usually weigh about 500 pounds per cubic foot.

Might Turn up Anywhere

Relatively few meteorites have been found on the Pacific Coast, but it is reasonable to suppose there are many more waiting systematic search. Wider interest and knowledge are needed. Many persons may have stumbled upon meteoritic matter without recognizing it. When more people know what to look for, we who study meteorites feel sure many more will be found. And they might turn up anywhere—no one place is more likely than another. The writer of this article will coöperate with any *PD* reader who has "meteorite suspicions" and sends specimen pieces with carefully written details of the "find"—where, when, how situated.

Of course, if you find another "Goose Lake meteorite," we shall not expect you to bring it or mail it in! A report of one anywhere near such size would bring specialists out to the location. Any amateur observer who discovers such a meteorite and shows the way to reach it will make a real contribution to science. But also important are the small ones, and fragments—they are just as valuable for scientific study, and may lead to the finding of something really big.

The greatest thrill of all, however, would be to witness and record the landing flight of the great fireball itself. And that could happen to anyone, any time.

How to Save Redwoods

—BUTANO FOREST AND SOUTH CALAVERAS GROVE

During the first quarter of this year, it was brought sharply to the attention of Californians that they were about to lose to the saw two of their finest remaining virgin forests—but that there was a chance to save them if the people acted immediately to influence pending state legislation which would effect their purchase and preservation as state parks.

If the South Calaveras Grove of Big Trees and "huge pine trees of greater size and impressiveness than any pines remaining in any other parts of the world," and the Butano Forest of Coast Redwoods were ordinary forests, their destruction might be accepted as economic necessity. But these are not ordinary forests. If the Calaveras Grove is felled, its like may never be seen on earth again. Butano, Mr. Barnard's letter below tells us, has a unique recreational value more vital than its worth as lumber. His outline of the Butano problem and action required to solve it applies in principle to the case of the South Calaveras Grove. Those who write as suggested should refer to both forests, or write separately in behalf of each one.

EDITOR, *Pacific Discovery*
SIR:

This is written in the hope that efforts to preserve a magnificent stand of Coast Redwoods will be of interest to all *Pacific Discovery* readers.

The Butano is a forest of prime Redwoods covering an area of 4,500 acres in San Mateo County, California. Only 50 miles down the Peninsula from San Francisco, it is vital to the recreational needs of the spreading Bay Area cities. At present, only Big Basin and Muir Woods are within an easy drive of the Bay Area. These are not enough for the present population of two million people, let alone the future. The planners of Golden Gate Park, the home of *Pacific Discovery*, were told that their project was unnecessarily big and would never be needed. Now the Park is the beloved back yard of hundreds of thousands of San Franciscans, whose city has completely surrounded it. Similarly, the Butano Forest will be surrounded before long, and, if only stumps and cutover land remain—where now flows the Butano Creek through aisles of giant trees and acres of rhododendrons and azaleas, the grieved people will ask, "How could they, as recently as 1949, not have foreseen our need?"

All efforts to bring the Butano Forest into the State Park system have failed so far, owing not to lack of interest but to a provision in California law which requires that funds expended by the State Park Commission for the purchase of an area for a state park must be matched dollar for dollar by the public from other sources. (When a new state hospital or new wing on the State Capitol is proposed, does it wait upon public subscription of half the funds?)

The 200 million board feet of timber in the Butano, priced at $6 per thousand board feet establishes the value at about $1,200,000. To raise the public's share, amounting to $600,000, would be a long and arduous task which at its conclusion would probably find the Butano Forest stacked in neat piles in lumber yards.

Logging crews are now poised at the edge of the Butano ready to do their job. To forestall this, a bill has been introduced into the California State Legislature by Assemblyman Dolwig which would direct the State Park Commission to purchase the Butano from its present owners, the Pacific Lumber Company, through negotiation or, if that fails, condemnation. The entire purchase price would be made available from a fund of $4,000,000 which still remains out of the $5,000,000 set aside in 1945 for purchase of inland parks by the State Park Commission.

This bill (Assembly bill 2339) will not become law unless our legislators and Governor Earl Warren know that the people of California desire it. Letters from Californians to their state senators and assemblymen and to Governor Warren from *Pacific Discovery* readers everywhere, urging them to act to save the Butano, should be sent to the State Capitol, Sacramento 14, California—immediately. Our letters may decide the issue.

JOHN R. BARNARD
Member, Board of Directors
Butano Forest Associates
Mill Valley, February 18, 1949

Editor David R. Brower, through whose courtesy we reprint Dr. Munz's letter, below, from the March Sierra Club Bulletin, *reported in the February* SCB:

The one-time deadline of March 1 for Calaveras has become evanescent. Apparently the lumber company [Pickering Lumber Corporation of Missouri], worried by strongly expressed public feeling, does not now want the public to infer that withdrawal on March 1 of its offer to sell [for $1,750,000 cash] meant that it would start cutting the trees instantly. It now appears to be better strategy to imply that the Calaveras forest is in no danger—and to cut when public feeling quiets down (which public feeling is supposed to do quickly).

The conservationists' answer is to keep up the present high caliber of their efforts.

The following letter is one of hundreds written in response to the appeal sent out to all conservation-minded persons in the Sierra Club Bulletin *for January 1949:*

Some twenty-two years ago Susanna Bixby Bryant, a native daughter of California, founded a Botanic Garden into which she poured millions of dollars in an effort to establish an institution for research on the plants of California and one where such plants could be grown and preserved for future generations not only for enjoyment but for scientific work. Even in the twenty-two years since the Garden was founded several species of California plants have passed out of existence in nature and are left now only in cultivation in such institutions, or no longer exist at all. Obviously as the population of California grows and the pressure for exploitation of natural resources increases, more and more protection of native species will be necessary. This can be achieved to some extent by Gardens but really effectively only by setting aside natural areas. These must be in many parts of the state and they must represent many different types of conditions. I have just completed a preliminary study of the various plant communities found in California and their diversity is tremendous. Moreover, these areas should be in their primitive condition in so far as possible, not changed by lumbering and agriculture.

California is one of the three or four geographic areas in the world that has contributed the largest number of ornamental plants for cultivation. Its number of species and their range in beauty and scientific interest are remarkable. In an area where such plants have grown undisturbed by man they have built conditions that are not obtainable elsewhere and that need scientific study and interpretation, a process which must go on for many years to come. If we do not in this generation set aside representative tracts that show California's vegetation as it once existed, we are not doing our duty to future generations.

Two such tracts are now under consideration by the people of the state, namely the South Calaveras Grove of Big Trees in the Sierra Nevada and the Butano Forest north of Santa Cruz. As a biologist with over thirty years of research experience in California, I urge that everything possible be done to rescue these tracts before they are lumbered and add them to the state park system. Not only are they important as possible additions to the recreational facilities of California, but such areas of virgin forest with their ecological and environmental complexes resulting from long periods of undisturbed growth, are of tremendous scientific significance. California has few such areas left.

PHILIP A. MUNZ
Director, Rancho Santa Ana Botanic Garden

THE INSECT GUIDE: Orders and Major Families of North American Insects. By Ralph B. Swain. Illustrated by SuZan N. Swain. Doubleday & Company, Inc., Garden City, New York. 1948. xlvi + 261 pp., 454 figs.—330 in full color, 124 in black and white. $3.00.

This is a well organized, well written guide to the orders and major families of North American insects. It differs from most manuals in its field in thus specially emphasizing higher divisions of the great class Insecta. When students attempt at the outset of their work to identify insects to species, they often lose sight of the all-important organization of the class. An orderly, phylogenetically arranged collection of the orders and families of insects is of more value, and is more challenging to the beginner, than a miscellaneous assortment of named species. Perhaps this book will direct the beginner away from the "what is the name of this species" mania.

The most striking feature of the book is the very excellent set of illustrations prepared by Mrs. Swain. The 330 full color drawings in particular will be great aids to beginners, as they depict most of the major families. In the large, clear reproductions, they truly resemble their subjects. It is unfortunate, however, that only the common names of the groups represented are given on the plates.

This book is recommended for the libraries of teenage naturalists and all others desiring a simple reference work in a complex field.

EDWARD S. ROSS

Department of Entomology
California Academy of Sciences
San Francisco

The following review appeared in the San Francisco Chronicle, *March 12, 1949, and is reprinted here by courtesy of the reviewer and the* Chronicle.

FISHING IN TROUBLED WATERS. By Wilbert McLeod Chapman. J. B. Lippincott Company, Philadelphia and New York. 1949. 256 pp., endpaper map. $3.00.

A book not to miss is *Fishing in Troubled Waters* . . . by Dr. Wilbert McLeod Chapman, long Curator of Fishes at the California Academy of Sciences and now special assistant to the Undersecretary of State in Washington.

In an informal kind of way this is a scientific book of course. But it is also a book of travel and adventure, and still further it is a book about the war.

The reason for this is the reason for Dr. Chapman's cruise in the first place.

Early in the war Uncle Sam decided that though the men in the South Pacific were well supplied with Spam, New Zealand lamb and K-ration, it might be as well to find out just what supplementary foods might come out of the sea in those regions. Dr. Chapman was sent to investigate, and spent many months wandering through the Central and South Pacific, fetching up eventually in the Solomons. This book is the record of a part of that expedition, some five months of it—a story, as the author puts it, of a "semi-commercial fishing enterprise" carried on while the war was taking place.

There were 10 aboard the 70-foot schooner *Crystal Star,* and Dr. Chapman's book is the delightfully written running narrative of their day-to-day lives—just scientific enough, containing just enough incident, and just thoughtful enough so that the mixture balances beautifully. You'll meet a group of people with whose members you'll be good friends before you have finished; you'll learn much you may not have known about the natives of the area; in short, you'll go along with the author and his crowd on as interesting a trip as you've ever read about anywhere.

What I hope is that the bookstores won't classify this under "ichthyology." It belongs among those highly personal narratives that defy classification, the books people read and recommend to others simply because they reflect a warm and interesting personality. That's really what makes this book what it is, too—the lively, good-natured, broad, full-packed mind of the man who writes it.

JOSEPH HENRY JACKSON

From "A Bookman's Notebook"
The San Francisco Chronicle, March 12, 1949

BREAKING NEW GROUND. By Gifford Pinchot. Harcourt, Brace and Company, New York. 1947. xvii + 522 pp. Illus. $5.00.

This is a timely book to read and consider, not only because its main theme—Conservation—is increasingly important but also because California in its Centennial years is stressing this vital issue more than ever. California Conservation Week is observed annually from March 7 to 14, and throughout the 51 weeks following the continuing emergency to which it refers is ever-present.

"Conservation" as a term in current use for a policy pertaining to natural resources was originated in 1907 by Gifford Pinchot, or by his associate Overton Price—said Pinchot, "I'm not sure which, and it doesn't matter."

The protection and wise use of our country's natural heritage had been advocated sporadically in earlier years, notably by associations representing the Sciences, but it was not until the time of Gifford Pinchot, during the Presidency of Theodore Roosevelt, that Conservation was dramatized and made effective. Its prime exponent, its *originator* in the larger view, is

the author of this autobiographical work. It is not a complete autobiography, for the book embraces mainly the period of Pinchot's life up to 1912, with only references here and there to his subsequent career. His death came in 1946. Pennsylvania is not in the Index; his services as Governor of that great commonwealth are not recounted, nor are his adventures as an independent in national political affairs during his later years.

In this book is a statement of how Gifford Pinchot brought practical forestry to America, and how this in the course of its development created the movement for conservation of natural resources, not half a century ago. That was the critical period of origination —as Theodore Roosevelt stated, Gifford Pinchot was "practically *breaking new ground.*"

Of course, the Pinchot-Ballinger controversy bulks large, and the chief forester did not pull his punches. William Howard Taft, he charged, "betrayed" the cause of Conservation. He broke with President Taft, he said, because "the public good comes first."

Pinchot was an advocate of Conservation for use; and he also recognized the value of preserving some of the finest of the forests in their primitive state, in perpetuity. He was an enthusiastic member of the Committee of Sponsors of the National Tribute Grove of ever-living Redwoods. "This Redwood memorial for our soldiers," he wrote me, "is a fine idea. . . . California coast Redwoods are among the most majestic trees on earth."

AUBREY DRURY

San Francisco, California

SUBMARINE GEOLOGY. By Francis P. Shepherd. *Harper's Geoscience Series.* Harper and Brothers, New York. 1948. xvi + 348 pp., 106 text figs., chart. $6.00.

For the science of geology, the publication of this book marks the beginning of a new era. The ultimate solution of the causes and principles behind the formation of the great submarine canyons and the giant flat-topped seamounts at depths of 800 fathoms, as well as the significance of coarse sediments in areas outside the limits of floating ice, appear to necessitate a revision of many of the classic concepts of geology.

Until the beginning of the modern investigations of which Dr. Shepherd's book is the first comprehensive world-wide report, the geologists' concepts of the features of the ocean floor and the processes taking place thereon were limited to the results of crude and comparatively isolated sampling and sounding. The results obtained were consequently generalized. Now, with the development of continuous profile sounding techniques, precision methods of determining geographic positions, greatly improved bottom sampling devices, submarine geophysical methods, and the underwater camera, our knowledge of the ocean floor has increased a thousandfold, and in a rapidly growing number of cases to a degree comparable to our knowledge of continental features. As a result, many undreamed of submarine features have come to light—some of them, such as the above mentioned submarine canyons, defying explanation by the so-called "normal processes." Consequently, as in the infancy of many other rapidly expanding branches of science, many new theories have been rapidly propounded and as rapidly discarded, oftentimes leaving a bewildered public in their wake.

Dr. Shepherd has been one of the leaders in the modern field of submarine geology since its inception, and this book presents an up-to-date summary of the present state of knowledge in that field—many items in fact are "hot off the wires." Each chapter is primarily concerned with a single topic, and after presentation of the factual data the leading hypotheses concerned with the subject are presented and discussed pro and con. A pertinent bibliography appears at the end of each chapter.

Chapter I deals with the history of and an introduction to submarine geology. An up-to-date summary of techniques for exploring the ocean floor is presented in Chapter II. Chapters III, IV, and V take up "Waves and Currents," "Classification of Sea Coasts and Shore-

lines," and "Beaches and Sand Shifting along the Shores." A new and apparently very good classification of shorelines is presented, along with an excellent discussion of forces which act on the shoreline.

Chapters VI and VII discuss the continental shelves, their topography, sediments, origin, and history. Among the more interesting items are the facts that the average depth of the boundary of the shelf is 72 fathoms and not 100 fathoms as conventionally defined, and that a natural boundary to the shelf does not occur in some cases until a depth of 200-300 fathoms. Further, the average width of the shelf is 42 miles and the average depth is 35 fathoms. On page 160 there is an interesting summary of facts about the shelf which have to be considered in any theories concerning its origin. This summary is recommended reading for any geologist or other person who has a hypothesis regarding the origin of the shelf.

In Chapter VIII there is a good discussion of the "Continental Slopes" and in Chapter IX those highly controversial features of the slope, "Submarine Canyons," are described and discussed. A number of excellent maps and cross sections of canyons are given, and it is to be noted that Monterey Canyon off the coast of California is fully comparable in profile with the Grand Canyon, although it is not as long. The discovery of flat-topped seamounts and banks in the Pacific at depths of about 800 fathoms is also highly intriguing. As a final puzzle in the picture presented in these two chapters, the occurrence of gravel, cobbles, and similar features usually considered characteristic of shallow water, is recorded from deep water.

"Coral Reefs" are discussed in Chapter X, "The Floor of the Deep Oceans" in Chapter XI, while Chapter XII is devoted to "Summary and Economic Applications." This last chapter is particularly potent reading, especially for the conventionally trained geologist. There is much in it to make one pause and think, particularly as one compares the factual data presented with the conventional interpretations of many features in the sedimentary part of the geologic record.

Shepherd finishes the book with the conclusion that a relatively late (probably Pleistocene) major submergence of the land masses on a world-wide scale is the most plausible explanation for the anomalous features of the ocean bottom that have been recorded in recent years. This book is highly recommended to all who are interested in the bottom features of the oceans and should be considered a "must" for every geologist who concerns himself with sedimentary rocks.

J. WYATT DURHAM
Department of Paleontology
University of California
Berkeley

CHEVRON
SUPREME
GASOLINE

Great on hills

SMOOTH PERFORMANCE! . . . that's what your car delivers every time when high octane Chevron Supreme is in the gas tank. And depend on it for easy starts, fast warm-up, dependable power no matter what the weather or altitude. That's because premium-quality Chevron Supreme Gasoline is climate-tailored to give you the right blend wherever you live, wherever you drive. Try a tankful of Chevron Supreme and you'll agree *it's a great gasoline!*

STANDARD STATIONS INC.

CHEVRON GAS STATION

We take better care of your car

Listen to "LET GEORGE DO IT," Mondays, 8 PM, PST, Mutual and 9 PM, MST, Intermountain Networks